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ABSTRACT

As part of a cooperative extension service series by the University of Maryland, this publication introduces the identification and control of common turf and plant pests that can be found in the urban environment. The first of the five sections defines "pest" and "weed" and generally introduces different kinds of pests such as insects, weeds, and diseases. Also in this section, the topic of pest controls is introduced. The second section is a tabular listing of "disease," "description and damage," and "control and management practices" for trees and shrubs, flowers and ground covers, and turf and lawn plants. The third section is a tabular listing of insect problems for the plant groups. The fourth section describes weeds and their control, and the fifth section is a collection of line drawings of common weeds to aid in their identification. One is referred to other publications in this series for specific pest control methods. (HR)

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COOPERATIVE EXTENSION SERVICE • UNIVERSITY OF MARYLAND • COLLEGE PARK, MARYLAND

ORNAMENTAL, TURF AND NURSERY PESTS

MEP 308

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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WHAT IS A PEST?

Plants or animals that are directly detrimental to man or interfere with his goals and interests are commonly called pests. Included are plant and animal diseases, insects (plus mites, ticks and spiders), weeds and vertebrates (mice, some birds, some predatory mammals).

Certain pest organisms are competitors with man while others are simply nuisances or annoyances. A select number of predators, parasites and disease organisms are a serious threat to humans and domesticated animals. Many pests have an indirect influence, such as insects that carry infectious microorganisms. Others are harmful because they interfere with commodity production. They may do damage to a crop or destroy stored products and materials.

Farming practices often aid the establishment of pest species. The one-crop system of agriculture, where susceptible crops are grown and livestock are grazed on the same area continuously over the years, encourages the buildup of certain pests. The pest is provided with a good supply of host plants or animals and can multiply to harmful levels.

Man sometimes moves crops, along with their pest organisms, into new areas. Naurally occurring predators may not be found at this new location, and therefore, the pest is allowed to flourish. In other cases, the natural predators of the pest have been removed.

There are numerous pest species in competition with man, and so far, there are none which he has been able to eradicate completely. Man can only attempt to control these organisms and keep their damage to acceptable levels.

INSECTS

GENERAL

Arthropoda is the largest group in the animal kingdom and includes organisms such as lobsters, crabs, crayfish, millipedes, spiders, scorpions, mites and a special class called insects. This class contains butterflies, bees, ants, flies, aphids, and many more. By pure numbers, the *Arthropoda* are the dominant form of animal life on earth, with millions contained in almost every acre of land. Fortunately, only a small portion are serious pests to man's interests. Insects, as a class, are the most adaptable of all animals. They can be readily found living in the earth's extremes of heat, cold, drought and darkness.

Beneficial species pollinate ornamental flowers and many agricultural crops thus providing us with many of our fruits and vegetables. They work in many specialized areas such as the production of silk and honey, and they also serve as a food source for many higher animal forms.

Some insects pose a real threat to man, either directly or indirectly. The damage to crops, stored products, man-made structures, and the health of man and animals is sometimes tremendous. Many insects can be the vectors of livestock and human diseases while others damage man-made structures or eat foodstuffs. Still others are undesirable because they are a general nuisance to man in his day-to-day activities.

STRUCTURE

An adult insect's body is elongated and divided into three regions, the head, thorax and abdomen. The eyes and antennae are located on the head, and the legs and wings are connected to the middle region, the thorax. All adult insects have six jointed legs, and these are sometimes used for identification purposes since they can vary slightly between species. The adult may have no wings or be equipped with one or two pairs.

Wings and mouthparts are most important in identification. Some insect mouthparts are designed for chewing while others are adapted for piercing a food source and sucking out the nutrient material.

The insect's body is surrounded by a hardened material which not only protects the internal organs but also acts as the insect's skeleton (exoskeleton). Breathing is done through a series of tubes that travel from the body surface to the internal areas, allowing oxygen from the outside to travel directly to the tissues.

GROWTH AND DEVELOPMENT

As an insect matures, it grows in size and often changes form. The rigid shell that covers the body and protects the insect as an exoskeleton will expand only so far. This exoskeleton must be shed at intervals to allow for the growing process. This shedding or "molting" process can occur many times as the organism matures. Before the old shell is cast aside, a new one, which will allow for growth, is already being formed underneath the old.

Insects, between these successive molting processes, are called "instars", and with each molt, the insect will differ in size and form from the preceding instar. This changing process will continue until the adult form is reached. Almost all insects change in shape and size as they mature, and this development process is referred to as metamorphosis.

METAMORPHOSIS

All insects carry on these growth and molting processes, and the successive instars differ in form and size. Some insect species show little variation as they mature, changing only in size. Others undergo an extreme transition where the adult fails to resemble the young insect in any way. This is evidenced by the development of caterpillars into butterflies. Every species follows one of these developmental series of events or a process that falls somewhere between the two.

A small number of insect species develop without any gross changes whatsoever. As they develop, they change only in size. The adult insect lays eggs, and the newly hatched young look just like miniatures of the adult. As the young insects grow, they proceed through a series of molts, maintaining their basic appearance, but increasing in size. Some of these insect species that reach maturity without going through metamorphosis also add additional body segments as they mature. Common examples of these are the silverfish and springtails.

GRADUAL METAMORPHOSIS: Species that are characteristic of this type of development differ from the preceding process in that the eggs hatch into nymphs. The maturing insect (nymph) looks somewhat like the adult all through its development. The nymph is equipped with wing buds which will not fully develop into functional wings until the final molting stage. The mouthparts, legs and antennae are basically the same as the adults. Some nymphs live in water and breathe by gills until they mature. Examples of insects that develop by gradual metamorphosis are cockroaches, grasshoppers, crickets, stink bugs, lice and cicadas.

COMPLETE METAMORPHOSIS: Most of the insects mature by this last growth process. They do not make a gradual change from nymph to adult. The immature and mature forms differ so greatly that one would not believe them to be the same insect, and quite often they live in very different habitats.

Their development proceeds through four stages. A *larva* hatches from the *egg*. In this stage, the insects are referred to as caterpillars, grubs or maggots, and it is at this time that many insects do their greatest damage. The larva shows continued growth and molting and may proceed through several instars. The larva may or may not have legs, and the head may lack development. If the adult is to be winged, the wings will begin to develop internally. At the end of the larval stage, the organism slows its activity and forms a smooth, hard, protective, outer covering and enters into the *pupal* stage. The insect does not feed during this period and is usually inactive. The final molt occurs at the end of the pupal stage, and the *adult* form emerges. Shortly thereafter, colors develop, and the wings expand and harden. Many familiar insects follow this pattern such as maggots to flies, grubs to beetles and caterpillars to moths and butterflies. Other common groups with complete metamorphosis are fleas, wasps, hornets and bees.

Other arthropods can be pests too, such as mites, ticks, spiders, millipedes and scorpions. These insect relatives molt and have other characteristics like insects but none have a pupal stage, nor do any have wings.

WEEDS

When plants grow in undesirable areas, they are referred to as weeds. Common crop plants are considered weeds if they grow and compete in a field that has been seeded for a different crop. Weeds can reduce crop yields, increase production costs and reduce the quality of crop and livestock products. Some are poisonous or cause skin irritation while others are undesirable simply because they reduce the aesthetic value of landscaped areas. The many different weeds fall into four categories according to their life cycles.

SUMMER ANNUALS

Plants of this type have a one-year life cycle and result from seeds that sprout in the spring or summer. These plants mature, produce seed for the next generation and die in one growing season. The seed produced will lie dormant and then germinate during the following spring. Seeds not germinating at this point may do so at a later time when conditions are again favorable. Crabgrass, foxtail and pigweed are summer annuals.

WINTER ANNUALS

Members of this group have a one-year life cycle and grow from seeds that sprout in the fall. They mature, produce seed and die before summer. Their initial growth in early winter may be inconspicuous, but the growth rate increases toward the end of winter, and flowers and seed are produced. The seeds of most winter annuals are dormant during the spring and summer but germinate with the arrival of fall. Some species, whose life cycles are timed with fall-sown grains, produce mature seeds at the time the grain is harvested. The weed seed mixes with the grain, creating problems in marketing. Some representative winter annuals are henbit, field pepperweed, annual bluegrass and chickweed.

BIENNIALS

Biennials have a two-year cycle. When grown from seed, they develop a heavy root and a compact cluster of leaves close to the ground in the first growing season. During the following growing season, they mature, flower, produce seed and die. There are only a few species of biennial weeds, but they may appear anytime during the growing season. Bull thistle is one common biennial.

PERENNIALS

Plants which live more than two years or indefinitely are called perennials. They can grow from seed or from vegetative parts such as tubers, bulbs, rhizomes (root-like stems) or stolons (modified above-ground stems that bend down and take root). Their encroachment into new areas does not completely depend on seed production. Rhizome and stolon pieces can be transported in soil or by equipment. Seed dispersal is the major method of introduction into new areas, and once established, they rapidly spread, often forming patches. Quackgrass, dandelions, plantains and Johnsongrass are examples of perennial weeds.

DISEASES

Any condition that impairs the normal development or execution of normal life functions of a plant or animal is referred to as a disease. These situations are most often brought about by the presence of bacterial, viral, protozoan or fungal pathogens and parasites. Each year, tremendous economic losses can be attributed directly or indirectly to diseases of domestic animals, poultry and crops. Animal diseases reduce production rates and meat value, and some of these infections take on greater importance due to the fact that they can spread to man. Ornamental and crop plants alike are the targets of plant diseases which lower quality and yields. Severe cases of some of these plant diseases can result in complete crop failure.

FUNGI

The fungi are lower forms of plant life and are a very diverse group. They are familiar to us in everyday life as mushrooms, toadstools, molds, mildews, rusts, rots and smuts. They grow and thrive on almost any substance, including such things as water, food, leather, fabric, fibers, paper, glass, plants and animals. Ringworm, athlete's foot and histoplasmosis are just some of the fungal diseases that directly affect man.

Fungi are beneficial in many ways. Their ability to decay plant and animal materials makes them very valuable for maintaining soil fertility. Fungi are used in the manufacture of organic acids, and drugs and in the food industry to produce cheese. Also, some yeasts are used in brewing and baking processes.

Fungi are a lower plant form and lack chlorophyll, the green substance used by higher plants to manufacture their own food. They must live and grow on dead organic matter as saprophytes or on living organisms as parasites. The fungus may kill the host or live and obtain nutrients without causing death.

Of all the parasitic diseases of plants, those caused by fungi are, by far, the most frequently encountered. Almost every plant is subject to infection by at least one type of fungi. In severe cases, quickly spreading diseases can result in crop failure. The devastating Irish potato famine which began in 1845 and the mildew diseases that destroyed the French wine industry from the 1870s to 1880s are examples of the effects of these diseases in agriculture. Not all parasitic fungi have such devastating effects but a variety of them still present a real problem in agriculture and its related activities. A few of the fungal plant diseases that frequently must be dealt with are wheat rusts, potato blights, tomato blights, powdery mildews of rose, lilac, chrysanthemum and other ornamentals, Dutch elm disease, and chestnut blight.

The development of most fungal growths consists of structures which are vegetative or reproductive. In the vegetative stage, the fungus grows on or through the substratum, (the material on which the fungus lives), obtaining nutrient materials by secreting enzymes to break down the cell walls. This vegetative growth may be a single cell or many cells in long thread-like filaments (hyphae). In many cases these hyphae are very difficult to see. As they grow and interlace, they stretch out and attach themselves to new substrate material.

In the reproductive stage, the fungus has the ability to reproduce itself by spores or other means. Compared to vegetative structures, the reproductive structures are much more visible. They develop from the vegetative structures and they differ greatly in form, depending on the genus and species. The common "mushroom" is nothing more than the reproductive portion of a fungus.

Spore formation is the most common method of reproduction in fungi. These are small one-cell units that germinate and form a new plant and are produced in several ways. Millions of spores can be produced by a single fungus and because of this, the surrounding air is more or less filled with spores. These spores can then be disseminated by air currents, splashing rain, insects or other factors. These spores may even be dormant in the soil during periods of unfavorable weather and germinate at a later time.

The factors that play a role in the seriousness of any fungal infection are the number of infecting spores, temperature, humidity, cultural practices, soil moisture and control methods.

BACTERIA

Bacteria are microscopic, single-celled organisms which are so small that many thousands can fit into a drop of water. They can be found everywhere—in air, soil, fresh and salt water, and on plants and animals. Many bacteria benefit man's interests. Some of these organisms decay materials in the soil, making it fertile, while others produce nitrogen in a form useful to plants. Bacteria have been classified and divided into three common forms: rod shaped, oval or sphere shaped and spiral configuration. Most require air for their continued growth but there are some that prefer to exist in the complete absence of oxygen.

Except for a small number that can produce their own carbohydrate food, bacteria survive by obtaining nourishment from the organic materials of plants and animals. Of these, most will grow on decaying plant and animal material while some exist as parasites which attack the living cells of plants and animals.

In a favorable environment, bacterial organisms reproduce themselves readily by the process of cell division. This is achieved by the formation of a crosswall in the cell and two daughter cells result. As this process continues, filaments or colonies are formed. These cells can resist dry conditions and temperature extremes, and some form spores inside when conditions become too unfavorable. Long after the cell is destroyed and more favorable conditions exist, these spores can develop.

Bacteria surround us and when the parasitic forms come in contact with a plant or animal under the right conditions, an infection or disease may result. Ingestion, inhalation or exposure of open wounds are just a few of the ways in which they can attack an animal.

Bacterial plant pathogens can be spread in a number of ways—by wind, water and soil movements, cultural practices, insects or animals. An insect carrying bacteria may feed on a plant and thereby infect the plant. Some bacteria may enter through the water pores and air openings of the plant or simply through wounds. Some may attack the root system also.

Livestock are targets of bacterial diseases such as anthrax, blackleg, brucellosis and mastitis and fowl cholera infects poultry.

The parasitic (pathogenic) bacteria are the causal organism for a wide variety of plant diseases including many spot diseases, wilts, rots, galls and blights. Fire blight and crown gall of fruit trees, wildfire of tobacco, leaf spot of carnations, black twig blight of lilacs, bacteria blight and bacterial wilt of soybeans, fire blight of apples and pears and bacterial wilt of sweet corn are just a few of the plant pathogens.

It is important to remember that some of these destructive diseases are difficult to identify and the symptoms of vastly differing diseases may be similar. After careful study, if a question remains, the advice of an expert might be warranted.

VIRUSES

Viruses are extremely small disease-causing organisms, so small that one must use an electron microscope just to see them. Because of size, their presence is detected only by the symptoms they produce. A particular virus is usually very specific in the type of host in which it infects and multiplies. Also, it will limit itself to one type of tissue. Since the response in the host is usually so specific, viruses are named for the type of disease they produce (hog cholera — hog cholera virus). Viruses are capable of

attacking anything from bacteria to plants and animals. As a cause of much human suffering and considerable losses to the agricultural economy, these pathogens are undergoing intense investigation by scientists.

In crop economic losses, they stand only second to the fungi in importance. Cucumbers, tobacco, sugar beets, corn, fruits, potatoes, asters, elm and beans are just a few of the plants subject to virus infection.

Animal disorders such as foot-and-mouth disease of cattle, hog cholera, Newcastle disease of chickens and rabies and distemper of dogs are all virus caused infections.

Viruses reside in living hosts as opposed to some of the bacteria and fungi that live and grow on decaying material. They must have a living host in order to reproduce themselves and manage to take over control of a host cell and direct it to produce material to make new viral particles. The virus cannot make this material itself. In the process the host cell is destroyed.

Plant viruses are divided into two groups according to the kind of injury they produce. One group, the Mosaics, produce a mottling or a characteristic ring spotting of the leaves. Yellowish spots and blotches make up the disease areas. The second viral type are the yellows, causing dwarfing, leaf curl and yellowing. Mosaics and yellows are responsible for great economic loss in crops, the former taking the greater toll.

Pathogenic plant viruses are spread by a variety of methods. Propagation techniques involving infected seeds, bulbs, roots, tubers or cuttings can allow virus diseases to take hold. Transmission can also occur through the use of contaminated equipment to handle healthy plants. Insects that feed upon plants such as aphids, mealybugs and leafhoppers, can carry the virus from plant to plant while they feed. Pollen, nematodes and fungi can also serve as vectors for virus.

NEMATODES

Nematodes (nemas) are roundworms of various sizes, some being parasitic for man and other animals, while others live on decaying material. The plant nematodes are very small, often microscopic, and are many times referred to as eelworms. Their life cycle includes an egg, four larval stages and an adult. Plant pathogenic nematodes live in soil and for the most part attack roots and other underground plant parts although above ground parts (leaves, stems, seeds) may be the target. As they feed their bodies become enlarged and rounded and swelling may occur in the attacked plant tissues.

Nemas may enter through air openings, water pores or by the wounds that result from mechanical injury. They may merely puncture the surface or enter completely and although the plant may not die, it is left in a weakened condition. As cells are destroyed or damaged, the plant is then left vulnerable to secondary infections by bacteria, fungi or viruses. Organisms of this type are responsible for economic losses in field crops (corn, alfalfa, soybeans, tobacco, etc.), vegetable crops (tomatoes, carrots, etc.), ornamentals and many turf varieties.

PLANT DISEASES

A plant disease may be described as any condition that interrupts the normal development of a plant by altering the appearance or function. Disease conditions may adversely affect the growth habit (stem, branches, roots), leaf shape and size, flowering and fruiting characteristics and all internal plant processes.

The causes of plant disease can be separated into two basic groups, the parasitic and the nonparasitic forms. The nonparasitic ones are classified together because they are all brought about by some unfavorable growth condition for the plant. Typical of the undesirable conditions are deficiencies or excesses in water or nutrient material, improper light, temperature extremes, mechanical injury and undesirable chemicals in the air and soil. Included in the parasitic group are those diseases caused by bacteria, fungi, nematodes (nemas) and viruses.

These parasitic organisms can be found on the interior or exterior of the plant, and the severity of infection will depend on the virulence of the disease and the plant's resistance. In most cases certain temperature and moisture conditions are required for infection, so therefore, climate plays an important role. Some disease organisms flourish only during rainy periods just as others cannot survive the extremes of cold.

Disease organisms must be able to overwinter in order to be able to infect plants during more favorable conditions. To do this, they may form resistant spores, or they may overwinter inside the host plant. Some may find protection in the seeds of plants while others may survive the winter in the tissues of an insect vector. Whatever the system, the life cycles of these parasitic organisms are all different and may vary from the extremely simple to the very complex.

Parasitic plant diseases are given a general classification by the types of visible symptoms they produce. They can be referred to as leaf spots, wilts, smuts, cankers, blights, blotches, rots and mildews.

SPOT DISEASES:

The spot diseases are recognized as a mark or blotch of discoloration found on the foliage or stem of the infected plant. They can be caused by numerous types of fungi and the accompanying environmental conditions. Each spot disease has a characteristic color and many are arranged in concentric rings. Each has a typical size and shape and in some cases, the disease affected area may also fall out forming a hole in the leaf. Certain insects may cause spotting of leaves.

WILT DISEASES:

Wilt conditions can be caused by a number of agents. Wilting may be due to a water deficiency or because of pathogens such as bacteria and fungi. In most cases, there has been a blockage of the water conducting system of the plant due to disease or mechanical injury.

DAMPING-OFF:

Any of several fungi can cause this rotting of seedlings and cuttings. Seedlings may be attacked after germination but before they break through the soil. Postemergence attack can also occur, resulting in the killing of roots and stems at the soil surface. As cells are destroyed the plant weakens and falls over.

SMUTS:

These diseases are called smuts because of the sooty-black masses of spores that they produce. The target of the infections are usually the heads of corn and other cereal crops. The cause of the diseases are the true smuts fungi of the order Ustilaginales. The powdery masses break into dust-like powder when disturbed and the spores are then dispersed by the wind. Many of the fungi enter the host plant at an early stage of the plant's development and grow with it until the plant reaches maturity.

RUSTS:

Although this name is commonly applied to many ailments resulting in reddish-brown spotting or color change in plants, it is most accurately used to describe infections caused by fungi of the family Uredinales. They must reside on living plants and grow internally. The fungus penetrates cells and then removes the cell's nourishment.

ROTS:

Any large-scale decay of living plant material by an organism may cause rot. The name "rot" is used to describe many conditions which are caused by bacterial or fungal infestations.

BLIGHTS:

This is a commonly used term describing diseases occurring because of attacks of bacterial, fungal or viral parasites. Undesirable climatic conditions are also a contributing factor. The target area is usually the young growth of a plant, and the end result is withering and general death of stems, leaves and flowers.

BLOTCHES:

General terminology such as this is used to describe diseases that arise from any of a number of plant pathogens. Usually, it is referring to the appearance of the diseased area. A plant with a blotch disease has infected areas that are irregular in size and shape, which separates them from the spot diseases.

CANKERS:

An area of diseased woody tissue is often described in this way. Infestation by any parasite or damage by other factors results in the shrinking and cracking of tissues, leaving an open wound.

MILDEW DISEASES:

Plant pathogens of this type are evidenced by fungal growth that form on the surface areas of a plant, such as the leaves and stems. It may appear white, gray, downy or powdery, giving rise to such names as "downy mildew" or "powdery mildew". The severity of tissue infection is dependent upon the type of fungal organism.

MOSAIC DISEASES:

Many virus diseases are given this name because of the mosaic-like appearance of diseased leaves of the host plant The leaves are mottled with light and dark areas and may show wilting and curling.

PEST CONTROLS

Man can encounter a wide variety of pest problems associated with his daily activities and interests. Whether they be diseases or unwanted plants and animals, the success of the control measures will depend on the use of a logical approach to the problem. The pest must first be identified. Knowing the characteristics of the pest organism and the crop or animal being threatened results in the choice of good control and management practices. The available control methods, including their risks and benefits, must be considered. The methods must be chosen that will be most effective and cause the least harm to the environment.

With most pest problems a condition arises, symptoms are analyzed, and then some type of corrective action is taken. However, not all pest problems can be attacked by this method. The approach to plant disease problems is one that differs in that the control is based primarily on prevention of the disease condition. In many cases, once the plant disease is recognized, it is too late for proper treatment.

There are control procedures available for treating pest problems and the degree of effectiveness depends on the type of problem and the severity. The following are the most important control methods.

NATURAL CONTROLS

A natural control is any ordinary condition in nature that slows down the reproduction and growth rates of pest species. Weather factors, such as moisture and temperature, are major control forces of insect and plant disease problems. Predatory and parasitic insects and some birds destroy many insect pests. Virus, fungus and bacteria diseases also take their toll among insects.

BIOLOGICAL CONTROLS

Biological controls involve man's use of natural predators, parasites, diseases and breeding techniques to reduce the numbers and economic impact of pest species. By releasing natural enemies, man can help control the pest. Aphid-parasitizing insects, one fungus antagonistic to another, and nematode-trapping fungi are all examples of biological controls.

Varieties of plants, which strongly resist disease and insect pests, have also been developed by man.

Another technique being used is the release of sterile male insects, causing interference in normal insect reproductive behavior.

PHYSICAL AND MECHANICAL CONTROLS

Physical controls are sometimes the most effective measures and include anything from fly swatters to ultra-high frequency sound production for killing pests. The use of radiation, distress and mating calls, repellents such as reflective "mulches", steam soil sterilization, and the various light, bait and sticky traps are all physical control methods. Other methods are electric shock grids, barriers, filters and fences for pest control. Habitat manipulation may involve flooding, drainage and nesting site destruction. Basic control measures for weeds are cultivation and the cutting of top growth to reduce weed vigor.

CULTURAL CONTROLS

Planting, growing, harvesting and tilling practices are all part of the cultural control of pests. Additional cultural control practices are crop rotation, construction methods, timing of planting and proper fertilization. With a knowledge of the pest, one can combine cultural controls with physical and mechanical practices to disrupt the normal association between a pest and its host.

Crop rotation can prevent the buildup of a pest population that favors one kind of plant. Some plant pathogens are unable to survive when a certain host is not present. Planting an alternative crop on which the parasite cannot exist will reduce parasite numbers after a time. The vulnerable crop can then be grown again.

Proper cultural practices, such as correct fertilization, will prevent certain diseases by producing vigorous plants. The removal of diseased plants and plant parts is very helpful in controlling diseases. Planting, tilling and cutting sequences are also a factor. The planting of crops in early spring before germination of weed seed will help avoid summer-annual weed problems. Insect pests can sometimes be controlled by carefully timed plowing which destroys a certain insect life stage.

CHEMICAL CONTROLS

Chemicals are used in a number of ways to control pest populations. They may be used to kill pests or they may act indirectly in the control method as repellents, attractants, sex stimulants, hormones or plant-growth regulators. The primary advantage of chemicals is speed in controlling pest problems, but in many cases their value is in protecting the host from possible disease infestations.

Pesticides and their related products come in many formulations. Most common are the emulsifiable concentrates, wettable powders, granules, aerosols (smokes, fogs, steam, vapors, etc.) baits (lures), dusts and impregnated materials.

Chemical control materials can be absorbed by pests in many ways. With contact absorption, the pest organism is adversely affected when it touches the pesticide. Plants can absorb herbicides through foliar (leaf) or root absorption. In the case of animal pests, some chemicals must be ingested before they take effect.

Some pesticides are referred to as systemics because they must be taken up and retained by the host. They render the potential plant or animal host toxic to pests feeding on it. The systemic may inactivate disease-produced toxins or directly attack the pest organism.

Certain chemicals act as pest repellents while others act as inhibitors of normal plant activity. Some weeds are controlled by photosynthetic-inhibiting herbicides which reduce weed vigor. Preemergence herbicides kill weed seedlings before or soon after they break the surface.

Other materials are referred to as chemical attractants and are used to lure insect pests to areas where they can be killed. These "pheromones" can be of an assembly-aggregation type or a sex attractant-sex stimulant type.

INTEGRATED CONTROLS

Often a combination of control methods is needed to achieve the desired effect. Combinations of bio-cultural controls, bio-physical controls and cultural-physical controls are very common.

When pests threaten, there are three basic approaches available to meet the problem.

PREVENTION: Steps can be taken to avoid infestations. Inspections and quarantines will help keep pests from infesting new areas. Clean conditions, cultural controls, treated seed, resistant varieties and pesticides all help to prevent problems.

SUPPRESSION: Once pest infestations have occurred, steps must be taken to reduce their numbers to acceptable levels. Chemical, cultural, physical and biological controls all help reduce the pest populations to keep damage to a minimum.

ERADICATION: In some cases, it is necessary to press control procedures even further to include the complete destruction of a pest in an animal or a crop area. Removal or destruction of diseased parts, or sterilization and fumigation of soil are examples of this total approach.

TREES AND SHRUBS
PLANT - DISEASE INDEX

ASH *(Fraxinus)*
- Anthrancnose
- Rust

AZALEA *(Rhododendron sp.)*
- Flower gall
- Flower blight
- Leaf gall
- Leaf spot
- Root rot
- Crown rot

BOXWOOD *(Buxus)*
- Canker

CRAB APPLE *(Malus)*
- Fire blight
- Powdery mildew
- Scab

DOGWOOD *(Cornus)*
- Anthracnose
- Canker
- Crown canker

ELM *(Ulmus)*
- Black leaf spot
- Dothiorella
- Dutch elm disease

EUONYMUS *(Euonymus)*
- Crown gall

FIRETHORN *(Pyracanthu)*
- Fire blight
- Scab

HAWTHORN *(Crataegus)*
- Fire blight
- Leaf spot
- Rust

JUNIPER *(Juniperus)* **or RED CEDAR**
- Tip blight

LILAC *(Syringa)*
- Powdery mildew

MAPLE *(Acer)*
- Leaf spot
- Tar spot
- Verticillium wilt

OAK *(Quercus)*
- Leaf spot
- Shoestring root rot

REDBUD *(Cercis)*
- Canker

RHODODENDRON *(Rhododendron sp.)*
- Flower gall
- Leaf gall
- Leaf spot
- Root rot
- Crown rot

ROSE *(Rosa)*
- Black leaf spot
- Canker
- Powdery mildew

SPRUCE *(Picea)*
- Canker

SYCAMORE *(Platanus)*
- Anthrancnose

DISEASE	DESCRIPTION AND DAMAGE	CONTROL AND MANAGEMENT PRACTICES
ANTHRACNOSE *(Gloesporium aridum)*	Ash Leaves with large irregular brown blotches usually along edges. Leaves fall prematurely. Serious only in wet spring.	Spray after new growth occurs.
(Elsin corni)	Dogwood Spotting of flowers, leaves, stems, bracts and fruit. Diseased leaf tissue drops out.	Prune to provide aeration. See Plant Pathology Mimeo 12.
(Gnomonia platani)	Sycamore Brown areas develop usually along veins. Leaves fall prematurely. Twig blight occurs, killing tips of 1-year-old twigs.	Destroy fallen leaves and twigs in the fall. See Plant Pathology Mimeo 18.
BLACK LEAF SPOT *(Gnomonia ulmea)*	Elm Gray irregular spots appear on upper leaf surface. Shiny black dots appear in center. Leaves turn yellow.	Rake and compost fallen leaves. See Plant Pathology Mimeo 12.
(Diplocarpon rosae)	Rose Circular black spots develop in early spring. Leaves turn yellow and fall. Plants are weakened by defoliation.	Prune canes in the spring. See Extension Fact Sheet 73.
CANKER *(Volutella buxi)*	Boxwood Leaves on individual branches turn light green, then tan. Entire branches may die. Leaves and bark are covered with pink spore masses.	Clean out leaves and other debris from bush interior. See Plant Pathology Mimeo 12.
(Botryosphaeria ribis)	Dogwood Blighting of terminals and twigs. Leaves turn brown and hang.	Prune dead twigs.

DISEASE	DESCRIPTION AND DAMAGE	CONTROL AND MANAGEMENT PRACTICES
CANKER *(Leptosphaeria coniothyrium)*	Rose Starts as a red spot on bark, drying out and turning brown. Stem may be girdled. Cankers develop at insect punctures and at pruning stubs.	Prune out cankered and dying stems.
(Valsa kunzei var. *piceae)*	Spruce Browning of branches near the ground and progressing upward.	Avoid wounding. Remove and destroy diseased branches.
(Botryosphaeria ribis)	Redbud Cankers develop at base of twigs and branches. Fungus is a wound pathogen. Girdled parts have off-color or dead leaves.	Prune cankered and weak branches.
CROWN CANKER *(Phytophthora cactorum)*	Dogwood Trees appear unhealthy. Leaves are smaller and light green, turning red in late summer. Leaves may shrivel. Twigs and branches die. Canker develops on trunk near soil level.	Avoid injuries to roots and lower trunk. Control borers.
CROWN GALL *(Agrobacterium tumefaciens)*	Euonymus Galls are usually rounded and are formed anywhere along the vine.	Remove and destroy infected plants. Avoid wounds of any kind. Use resistant plants or disease-free (gall) stocks.
CROWN ROT *(Phytophthora cactorum)*	Rhododendron and Azalea Off-color of foliage which may curl and/or wilt. May be discoloration of tissues under the bark.	Soil should be acid. Select light soils that are well-drained. Avoid injuries to roots.
DOTHIORELLA WILT or DIEBACK *(Dothiorella ulmi)*	Elm Foliage wilts and yellows. Discoloration occurs in outer rings of the wood. Cankers develop on stems.	Culturing required. Prune infected branches. Fertilize trees low in vigor.
DUTCH ELM DISEASE WILT *(Ceratocystis ulmi)*	Elm Yellowing, wilting and browning of leaves on branches which "flag" and die. Brown streaks appear in sapwood under bark. Culturing required to separate wilt diseases.	Prevent feeding of elm bark beetles. Remove diseased trees. Certain species of elms are resistant.

DISEASE	DESCRIPTION AND DAMAGE	CONTROL AND MANAGEMENT PRACTICES
FIRE BLIGHT *(Erwinia amylorora)*	Crab apple Blossoms and leaves of infected twigs wilt. Dead leaves persist. Cankers develop on older wood.	Prune diseased parts when twigs are dry.
	Firethorn (See FIRE BLIGHT — Crab apple)	
	Hawthorne (See FIRE BLIGHT — Crab apple)	
FLOWER BLIGHT *(Ovulinia azaleae)*	Azalea White spots on petals followed by collapse. Small black sclerotia develop within a week. Infected blossoms hang on the bushes.	See Plant Pathology Mimeo 12.
FLOWER GALL *(Exobasidium vaccinii)*	Azalea and Rhododendron Galls on bladder-like enlargements of leaf or flower bud. They are white at first, then turn brown and hard.	Handpick the galls and destroy. See Plant Pathology Mimeo 12.
LEAF GALL	Azalea and Rhododendron (See FLOWER GALL — Azalea and Rhododendron)	
LEAF SPOT *(Pestalotia spp.)*	Azalea and Rhododendron Silver-gray spots on upper surface of leaves. Often follows winter injury.	Pick and destroy infected leaves. Avoid shade.
(Fabraea thuemenii)	Hawthorn Small dark brown spots are numerous over leaf. Leaves drop prematurely.	Avoid shade. Prune to open trees.
(Phyllosticta minima)	Maple Several diseases. Purple eye is common. Purple border with brownish centers.	Usually are not destructive. No control needed.
(Taphrina caerulescens)	Oak Leaf blister causes circular raised areas on upper surface with a depression on lower surface. Spots are yellowish-brown.	Usually are not destructive. No control needed.

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DISEASE	DESCRIPTION AND DAMAGE	CONTROL AND MANAGEMENT PRACTICES
POWDERY MILDEW *(Podosphaera leucotricha)*	Crab apple Patches of white or gray powdery coating on leaves and twigs.	Plant resistant varieties. Prune mildewed twigs when trees are dormant.
(Microsphaera alni)	Lilac Leaves covered with white patches mid to late season.	Avoid shady, poorly ventilated locations. See Plant Pathology Mimeo 12.
(Sphaerotheca pannosa var. *rosae)*	Rose Patches of white fungus develop on new growth. Affected leaves are curled and distorted. Buds and stems are distorted.	See Extension Fact Sheet 73.
ROOT ROT	Azalea and Rhododendron (See CROWN ROT)	
RUST *(Puccinia sparganoides)*	Ash Leaves and twigs are distorted and covered with distinct yellow-orange pustules.	Rarely serious enough to use special control measures.
(Gymnosporangium globosum)	Hawthorn Leaves (but rarely the fruit and stems) are attacked causing orange colored spots. Premature defoliation occurs.	Hawthorn and red cedar (juniper) should not be grown together. See Plant Pathology Mimeo 12.
SCAB *(Venturia inaequalis)*	Crab apple Olive green to sooty colored spots appear on leaves and fruits. Leaves wither and entire tree takes on a dark appearance. Leaves drop and fruit is disfigured.	Plant resistant varieties. Destroy fallen leaves. See Plant Pathology Mimeos 4 and 12.
(Fusicladium pyracanthae)	Firethorn Sooty or velvety spots appear on the leaves which turn yellow and drop prematurely. A black, scab-like discoloration may cover half or all the berry surface.	Avoid shady moist locations. See Plant Pathology Mimeo 12.

DISEASE	DESCRIPTION AND DAMAGE	CONTROL AND MANAGEMENT PRACTICES
SHOESTRING ROOT ROT *(Armillaria mellea)*	Oak A rotting of the bark and wood of roots and root collar occurs. Black root-like strands on the roots are symptoms of the organism.	Maintain soil fertility.
TAR SPOT *(Rhytisma acerinum)*	Maple On red and silver maples, black spots on upper surfaces are conspicuous.	Seldom a serious disease. Fallen leaves should be collected.
TIP BLIGHT *(Phomopsis juniperovora)*	Red Cedar or Juniper Small brown cankers appear on the young twigs. Girdling and a dieback follows.	Prune diseased twigs. See Plant Pathology Mimeo 12.
VERTICILLIUM WILT *(Verticillium albo-atrum)*	Maple Sudden wilting and dying of leaves on individual branches. Greenish streaks in the sapwood are symptoms.	Prune infected branches. If severe, remove tree. Use fertilizers to promote growth.

FLOWERS, BULBS AND GROUND COVERS

PLANT - DISEASE INDEX

AFRICAN VIOLET *(Saintpaulia)*
- Botrytis blight or
- Gray mold

BEGONIA *(Begonia* sp.*)*
- Botrytis blight or
- Gray mold

BUGLEWEED *(Ajuga)*
- Crown rot

CARNATION *(Dianthus caryophyllus)*
- Alternaria blight or
- Branch rot or
- Collar rot

CHRYSANTHEMUM *(Chrysanthemum* sp.*)*
- Flower blight
- Leaf spot
- Powdery mildew

DAHLIA *(Dahlia)*
- Botrytis blight or
- Gray mold

GERANIUM *(Pelargonium* sp.*)*
- Black leg or
- Stem rot
- Cutting rot
- Botrytis blight or
- Gray mold

GLADIOLUS *(Gladiolus)*
- Corm rot
- Leaf spot

IRIS *(Iris* sp.*)*
- Leaf spot

IVY *(Hedera helix)*
- Leaf spot

LILY *(Lilium* sp.*)*
- Botrytis blight or
- Gray mold and
- Leaf spot

PACHYSANDRA *(Pachysandra)*
- Stem canker or
- Stem blight

PEONY *(Paconia)*
- Botrytis blight or
- Gray mold

TULIP *(Tulipa)*
- Botrytis blight or
- Gray mold and
- Leaf spot

VINCA *(Vinca)*
- Stem canker or
- Stem blight

ZINNIA *(Zinnia)*
- Powdery mildew
- Alternia blight or
- Branch rot or
- Collar rot

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DISEASE	DESCRIPTION AND DAMAGE	CONTROL AND MANAGEMENT PRACTICES
ALTERNIA BLIGHT or BRANCH ROT or COLLAR ROT *(Alternaria dianthi)*	Carnation Ash-gray spots on lower leaves that become dark brown or black. Blight at leaf bases and nodes causes girdling.	Select healthy cuttings. Keep foliage dry.
(Alternaria zinniae)	Zinnia Small reddish-brown spots with gray centers increase to brown, dry areas. Cankers may girdle stems. Roots may rot. Flowers may be blighted.	Clean up refuse. Use fungicides starting in June. See Plant Pathology Mimeo 12.
BLACK LEG or STEM ROT and CUTTING ROT *(Pythium spp.)*	Geranium Stems of cuttings blacken and rot.	Sterilize soil before use. Avoid excessive watering.
BOTRYTIS BLIGHT or GRAY MOLD *(Botrytis cinerea)*	African violet Leaves and stems blighted or rotted. Brownish-gray mold develops.	Avoid overwatering and crowding. Remove decayed plant parts.
	Begonia Dead areas in leaves and flowers. Profuse brownish-gray mold.	Avoid wetting leaves. Remove decayed parts.
	Dahlia Young shoots, flower buds and flowers may be blighted and covered with grayish mold.	Remove blighted buds and flowers.
	Geranium Petals are discolored. Flowers drop. Gray mold develops on leaves.	Avoid wetting leaves. Remove decayed parts.
(Botrytis paeoniae)	Peony Brown or blackish rot at base of stem. Buds turn black and often never develop. Flowers are attacked at any stage causing a decay.	Cut all tops in fall to ground level. Avoid mulch close to plants. Remove all blighted parts. See Plant Pathology Mimeos 11 and 12.

DISEASE	DESCRIPTION AND DAMAGE	CONTROL AND MANAGEMENT PRACTICES
BOTRYTIS BLIGHT or GRAY MOLD or LEAF SPOT *(Botrytis elliptica)*	Lily Distinct spots on leaves and flowers. Whole leaf may be blighted.	Avoid dense planting and shade. Clean-up infected plant parts.
(Botrytis tulipae)	Tulip Malformed leaves and shoots may have areas similar to frost injury. Plant may be pale yellow, stunted and flowers blasted. Gray mold present.	Provide air circulation; do not crowd. Remove blighted leaves and flowers. See Plant Pathology Mimeo 12.
CORM ROT *(Fusarium oxysporum f. gladioli)*	Gladiolus Lesions and spots on corms. Plants turn yellow. Corms may decay in storage.	Cure corms after digging at 95° F. Use resistant varieties.
CROWN ROT *(Sclerotium rolfsii)*	Bugleweed White mycelial growth near soil on leaves, etc. Plant wilts and turns black.	Remove diseased plants as soon as noticed.
FLOWER BLIGHT *(Ascochyta chrysanthemi)*	Chrysanthemum Young buds do not open. Upper stem and flowers wither and turn black.	Keep plants well-spaced. Do not wet foliage. See Plant Pathology Mimeo 12.
LEAF SPOT *(Septoria chrysanthemella)*	Chrysanthemum Dark spots increase to destroy whole leaf. Leaves hang down on stems.	Do not crowd plants. See Plant Pathology Mimeo 12.
(Stemphylium sp.)	Gladiolus Spots on leaf or stem are tan to brown. Stems may be girdled.	Use resistant varieties.
(Didymellina macrospora)	Iris Dark spots with reddish-brown borders on leaves. Repeated spotting weakens plants.	Remove old leaves at end of season. Cut back spotted leaves in midsummer. See Plant Pathology Mimeo 12.
(Xanthomonas hederae)	Ivy Dark spots with reddish margins on leaves.	Remove infected and unsightly leaves.

DISEASE	DESCRIPTION AND DAMAGE	CONTROL AND MANAGEMENT PRACTICES
POWDERY MILDEW *(Erysiphe cichoracearum)*	Chrysanthemum Leaves covered with whitish powdery mildew. Usually starts late in season.	See Plant Pathology Mimeos 12 and 16.
	Zinnia Powdery white mildew on leaves. Black fungus bodies are formed.	See Plant Pathology Mimeo 12.
STEM CANKER or STEM BLIGHT *(Volutella pachysandrae)*	Pachysandra Large brown spots on leaves. Sunken cankers on stems with pink spore masses.	Keep fallen leaves out of beds. Remove diseased plants. Thin plant beds. See Plant Pathology Mimeo 12.
(Phomopsis lirella)	Vinca Leaves and stems wilt and turn black. Plants are killed. Rainy spring favorable.	Remove infected plants. See Plant Pathology Mimeo 14.

DISEASE	DESCRIPTION AND DAMAGE	CONTROL AND MANAGEMENT PRACTICES
BROWN PATCH *(Rhizoctonia solani)*	Fungus causing brown patch attacks nearly all species of grasses. Disease occurs during warm, humid or wet weather. Disease symptoms appear as irregular circular areas from a few inches to several feet in diameter causing a brownish discoloration. Different grasses vary. The outer perimeter of the ring appears to have a smoky gray cast associated with impending death of the plants at the outer edge of activity. If the hot weather breaks, the grass may recover. During extended hot humid periods, the fungus may kill the grass.	Use good management practices. Avoid excessive nitrogen fertilizer. Use chemical sprays; water grass in early morning. See Plant Pathology Mimeo 50 for fungicide recommendations.
DAMPING OFF	(See PYTHIUM BLIGHT)	
DOLLAR SPOT *(Sclerotinia homoeocarpa)*	Disease occurs in hot, dry weather and usually appears from June to October. Occurs on many grasses and starts as small patches. The spots may be bleached. Individual leaf lesions appear as bleached areas approximately 3/8 inch long bordered by reddish-brown bands at the outer edge of the necrotic or diseased area.	Use chemical sprays. Maintain adequate nitrogen levels. See Plant Pathology Mimeo 50 for fungicide recommendations and Agronomy Mimeo 26 for fertilization recommendations.
EYE SPOT	(See FADING OUT)	
FADING OUT, LEAF SPOT, EYE SPOT, etc. *(Helminthosporium* spp.) and *(Curvularia* spp.)	Grasses are susceptible to a number of diseases due to this fungi. Leaf spots are present, varying in size and color. The leaf blade, leaf sheath, crown and roots may be affected. Small to large areas may die out. General yellowing occurs in irregular dead patches. Disease begins in leaf lesion stage and eventually develops into crown rotting phase (fading out) in late summer.	Use resistant varieties and mixtures. Remove thatch. Fertilize according to University of Maryland recommendations. Mow grass at two inches. Use chemical when economically possible. See Plant Pathology Mimeo 50 for fungicide recommendations and Agronomy Mimeo 77 for variety recommendations.

DISEASE	DESCRIPTION AND DAMAGE	CONTROL AND MANAGEMENT PRACTICES
FAIRY RINGS *(Marasmius)*	A dark green band of turf develops along outer edge of circular ring. Grass usually dies on inner side of ring. Fungus growth progresses outward each year at the rate of several inches to one to two feet. Mushrooms appear in the ring in moist weather. Most grasses are affected. Grass may grow back within ring.	No definite control known that is practical. Remove turf and soil, then fumigate area. The latter method is expensive.
FUSARIUM BLIGHT *(Fusarium noseum, Fusarium tricinctum)*	Disease occurs usually in hot, humid, moisture limiting weather. A "frog eye" pattern may appear. Overall visible pattern appears as dead half circle or complete circle with a living center. A pinkish growth of the fungus may be seen in the crown areas. Many grasses are attacked.	Avoid heavy nitrogen fertilizers during spring and summer. Keep grass cut and maintain adequate moisture. Use appropriate fungicides. See Plant Pathology Mimeo 50 for fungicide recommendations.
GREASE SPOT	(See PYTHIUM BLIGHT)	
LEAF SPOT	(See FADING OUT)	
POWDERY MILDEW *(Enysiphe graminis)*	First appearance is a fine, gray-white, cobwebby growth on upper surface of leaf. Entire leaf blade may be covered. Small to large sections of grass may be involved. Disease occurs only in shade.	Use resistant varieties and mixtures. Establish pruning procedures which allow optimum air movement. Reduce turf shading and high humidity in cool periods. Use appropriate chemical fungicides. See Plant Pathology Mimeo 50 for fungicide recommendations and Agronomy Mimeo 77 for variety recommendations.
PYTHIUM BLIGHT DAMPING OFF and GREASE SPOT *(Pythium spp.)*	When present in grass in wet weather, a white cottony mold growth appears on affected leaves in the morning. Infected blades turn dark, become matted and have a greasy appearance. Small areas or entire lawns may be affected or killed. All grasses are attacked. Disease is found in low spots, waterways.	Provide for good drainage. Avoid overwatering. Use appropriate fungicides. See Plant Pathology Mimeo 50 for fungicide recommendations.
RUST *(Puccinia spp.)*	Small yellow-orange or red-brown powdery postules develop on leaves and stems. Most grasses are attacked. Merion Kentucky bluegrass is particularly susceptible.	Use resistant varieties and mixtures of grasses. Use good cultural practices. Repeated application of spray chemicals will help. See Plant Pathology Mimeo 50 for fungicide recommendations and Agronomy Mimeo 77 for variety recommendations.

DISEASE	DESCRIPTION AND DAMAGE	CONTROL AND MANAGEMENT PRACTICES
SLIME MOLD (Slime mold fungi)	Most grasses may be affected. Grass blades covered with small, crust-like, light to dark-gray fruiting bodies of the fungus. The fungi are not parasitic but are unsightly, and they shade and discolor the blades. Slime molds occur during wet weather; they disappear as soon as it becomes dry.	Slime molds can be broken up by sweeping with a broom or spraying with a strong stream of water. Spraying with a turf fungicide is seldom necessary.
SNOW MOLD *(Typhula* spp.*)* *(Fusarium)*	Disease usually is seen at the first spring thaw. The spots appear as yellow discolored areas of a few inches up to a foot or more. Later the spots merge producing large dead areas. Color changes to whitish gray. The difference between the *Typhula* and *Fusarium* is that *Typhula* produces small, brown, nesting bodies, pinhead in size. The *Fusarium* fungus appears with a pinkish color.	Reduce thatch; raking helps break up matted grass; apply fungicide before first snow. Use resistant varieties. Avoid high levels of nitrogen late in the fall in areas prone to snow mold attack. See Plant Pathology Mimeo 50 for fungicide recommendations.
STRIPE SMUT *(Ustilago striiformis)*	Long narrow streaks, gray to black, develop lengthwise along leaf blades. Leaves curl and shred from tip down before dying.	Use fungicides. Use resistant varieties and mixtures. See Plant Pathology Mimeo 50 for fungicide recommendations.

PLANT - INSECT INDEX

AFRICAN VIOLET *(Saintpaulia)*
- Aphid
- Cyclamen mite
- Mealybug

ANDROMEDA *(Andromeda)*
- Aphid
- Lace bug
- Spider mite

ARBORVITAE *(Thuja)*
- Arborvitae leaf miner
- Bagworm
- Spider mite

ASH *(Fraxinus)*
- Aphid
- Fall webworm
- Lace bug
- Mountain ash sawfly
- Spider mite

ASTER *(Aster)*
- Aphid
- Leafhopper
- Spider mite
- Thrips
- Whitefly—(See Greenhouse whitefly)

AZALEA *(Rhododendron)*
- Aphid
- Azalea caterpillar
- Azalea lace bug
- Azalea leaf miner
- Azalea whitefly
- Black vine weevil
- Japanese weevil
- Spider mite

BARBERRY *(Berberis)*
- Indian wax scale
- Japanese weevil

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BEECH *(Fagus)*
- Aphid
- Lace bug
- Redhumped oakworm
- Saddled prominent
- Walnut caterpillar
- Yellownecked caterpillar

BEGONIA *(Begonia sp.)*
- Aphid
- Mealybug
- Spider mite
- Thrips
- Whitefly (See Greenhouse whitefly)

BIRCH *(Betula)*
- Aphid
- Birch leafminer
- Bronze birch borer
- Cankerworms (fall and spring)
- Eastern tent caterpillar
- Fall webworm
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- Oystershell scale
- Saddled prominent
- Spider mite
- Yellownecked caterpillar

BITTERSWEET *(Celastrus)*
- Aphid
- Euonymus scale

BOXELDER *(Acer negundo)*
- Aphid
- Boxelder bug
- Fall webworm
- Greenstriped mapleworm
- Spider mite

BOXWOOD *(Buxus)*
- Boxwood leafminer
- Boxwood psyllid
- Spider mite

CAMELLIA *(Thea)*
- Aphid
- Black vine weevil
- Indian wax scale
- Japanese weevil

CARNATION *(Dianthus caryophyllus)*
- Aphid
- Spider mite
- Thrips

CHRYSANTHEMUM *(Chrysanthemum)*
- Aphid
- Fourlined plant bug
- Garden fleahopper
- Lace bug
- Leafhopper
- Spider mite
- Tarnished plant bug
- Thrips
- Whitefly (See Greenhouse whitefly)

COLEUS *(Coleus)*
- Fourlined plant bug
- Mealybug
- Spider mite
- Whitefly (See Greenhouse whitefly)

COLUMBINE *(Aquilegia)*
- Aphid

COTONEASTER *(Cotoneaster)*
- Aphid
- Lace bug
- Leafhopper
- Spider mite

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CRAPEMYRTLE *(Lagerstroemia)*
- Aphid

DAHLIA *(Dahlia)*
- Aphid
- Fourlined plant bug
- Leafhopper
- Spider mite
- Tarnished plant bug
- Thrips

DEUTZIA *(Deutzia)*
- Aphid
- Japanese weevil

DOGWOOD *(Cornus)*
- Calico scale
- Dogwood borer
- Dogwood clubgall midge
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- Leafhopper

DOUGLAS-FIR *(Pseudotsuga)*
- Cooley spruce gall aphid
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ELM *(Ulmus)*
- Aphid
- Elm leaf beetle
- Japanese beetle
- European elm scale
- Fall cankerworm
- Fall webworm
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- Smaller european elm bark beetle
- Spider mite
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EUONYMUS *(Euonymus)*
- Aphid
- Black vine weevil
- Euonymus scale
- Indian wax scale
- Japanese weevil

FERNS *(Polypodiaceae)*
- Aphid
- Brown soft scale
- Hemispherical scale
- Mealybug

FIR *(Abies)*
- Aphid (including woolly)
- Balsam twig aphid
- Bagworm
- Pine needle scale
- Spider mite

FLOWERING FRUITS
- Aphids (including woolly)
- Cankerworms (fall and spring)
- Eastern tent caterpillar
- European fruit lecanium
- Oystershell scale
- Peach tree borer
- San Jose scale
- Spider mite
- Terrapin scale
- White peach scale

FOLIAGE PLANTS (greenhouse)
- Aphid
- Brown soft scale
- Hemispherical scale
- Mealybug
- Spider mite
- Whiteflies (See Greenhouse whitefly)

GARDENIA *(Gardenia)*
- Aphid
- Black vine weevil
- Brown soft scale
- Hemispherical scale
- Mealybug
- Whitefly (See Greenhouse whitefly)

GERANIUM *(Pelargonium* sp.)
- Aphid
- Fourlined plant bug
- Japanese weevil
- Spider mite
- Whitefly (See Greenhouse whitefly)

GLADIOLUS *(Gladiolus)*
- Aphid
- Fourlined plant bug
- Garden fleahopper
- Leafhopper
- Spider mite
- Tarnished plant bug
- Thrips

HACKBERRY *(Celtis)*
- Lace bug
- Leafhopper
- Spider mite
- Whitefly—(See Greenhouse whitefly)

HAWTHORN *(Crataegus)*
- Aphid
- Cankerworms (fall and spring)
- Eastern tent caterpillar
- Lace bug
- Spider mite

HEMLOCK *(Tsuga)*
- Aphids (including woolly)
- Bagworm
- Elongate hemlock scale
- Indian wax scale
- Spider mite

HICKORY *(Carya)*
- Aphid
- Cankerworms (fall and spring)
- Fall webworm
- Lacebug
- Twig girdler
- Twig pruner
- Walnut caterpillar

HOLLY *(Ilex)*
- Aphid
- Holly leaf miner
- Holly looper
- Indian wax scale
- Japanese weevil
- Spider mite

HOLLYHOCK *(Althea rosea)*
- Aphid
- Japanese beetle
- Lace bug
- Spider mite
- Tarnished plant bug
- Thrips

HONEY LOCUST *(Gleditsia)*
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- Mimosa webworm
- Spider mite
- Spring cankerworm
- Twig girdler
- Walnut caterpillar

IRIS *(Iris)*
- Aphid
- Iris borer
- Thrips

IVY, Boston *(Parthenocissus tricuspidata)*
- Japanese beetle
- Leafhopper

IVY, English *(Hedera helix)*
- Aphid
- Fourlined plant bug
- Mealybug
- Spider mite

JUNIPER, RED CEDAR *(Juniperus)*
- Aphid
- Bagworm
- Juniper webworm
- Spider mite

LILAC *(Syringa)*
- Aphid
- Giant hornet
- Japanese weevil
- Lilac borer
- Oystershell scale

LINDEN, BASSWOOD *(Tilia)*
- Aphid
- Fall cankerworm
- Japanese beetle
- Lace bug
- Spring cankerworm
- Twig girdler

LOCUST *(Robinia)*
- Aphid
- Bagworm
- Locust borer
- Locust leafminer
- Spider mite

MAGNOLIA *(Magnolia)*
- Aphid
- Calico scale
- Indian wax scale
- Tuliptree scale

MAPLE *(Acer)*
- Aphid (including woolly)
- Calico scale
- Cottony maple scale
- Fall cankerworm
- Gloomy scale
- Japanese maple scale
- Lace bug
- Leafhopper
- Maple bladdergall mite
- Oystershell scale
- Spider mite
- Spring cankerworm
- Twig pruner
- Whitefly (See Greenhouse whitefly)

MIMOSA, SILK-TREE *(Albizia Julibrissin)*
- Mimosa webworm

MOUNTAIN ASH *(Sorbus)*
- Aphid
- Mountain ash sawfly
- Spider mite

OAK *(Quercus)*
- Aphid
- Cankerworms (spring and fall)
- Galls (gouty and bullet)
- Golden oak scale
- Lace bug
- Oak skeletonizer
- Obscure scale
- Orangestriped oakworm
- Redhumped oakworm
- Saddled prominent
- Twig girdler
- Twig pruner

PACHYSANDRA *(Pachysandra)*
- Euonymus scale
- Spider mite

PETUNIA *(Petunia)*
- Aphid
- Garden fleahopper
- Leafhopper
- Spider mite
- Tarnished plantbug

PINE *(Pinus)*
- Aphid
- Bagworm
- Nantucket pine tip moth
- Pales weevil
- Pine bark aphid
- Pine needle scale
- Redheaded pine sawfly
- Southern pine beetle
- Spider mite
- White pine aphid
- White pine weevil

POPLAR, ASPEN, COTTONWOOD *(Populus)*
- Bronze birch borer
- Fall webworm
- Lacebug
- Oystershell scale
- Poplar tentmaker
- Twig girdler

PRIVET *(Ligustrum)*
- Japanese weevil
- Spider mite
- Thrips
- White peach scale

PYRACANTHA *(Pyracantha)*
- Aphid
- Indian wax scale
- Japanese maple scale
- Lace bug
- San Jose scale
- Spider mite

RHODODENDRON *(Rhododendron)*
- Blackvine weevil
- Giant hornet
- Japanese weevil
- Lace bug

ROSE *(Rosa)*
- Aphid
- Fourlined plant bug
- Japanese beetle (adults)
- Japanese weevil
- Leafhopper
- Rose midge
- Spider mite
- Tarnished plant bug
- Thrips

SNAPDRAGON *(Antirrhinum)*
- Aphid
- Fourlined plant bug
- Spider mite
- Tarnished plant bug

SPIRAEA *(Spiraea)*
- Aphid
- Indian wax scale
- Leafhopper
- Spider mite

SPRUCE *(Picea)*
- Aphid
- Bagworm
- Balsam twig aphid
- Cooley spruce gall aphid
- Eastern spruce gall aphid
- Pales weevil
- Pine needle scale
- Spider mite
- White pine weevil

SYCAMORE, PLANE *(Platanus)*
- Aphid
- Bagworm
- Fall webworm
- Lace bug

TULIPTREE *(Liriodendron)*
- Aphid
- Tuliptree scale

VIBURNUM, SNOWBALL *(Viburnum)*
- Aphid

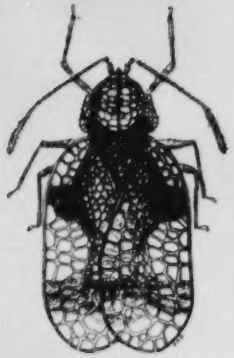
WALNUT *(Juglans)*
- Aphid
- Fall webworm
- Lace bug
- Spider mite
- Walnut caterpillar

WILLOW *(Salix)*
- Aphid
- Fall webworm
- Imported willow leaf beetle
- Oystershell scale

YEW *(Taxus)*
- Black vine weevil (grubs and adults)
- Spider mite
- Taxus mealybug

ZINNIA *(Zinnia)*
- Aphid
- Fourlined plant bug
- Garden fleahopper
- Japanese beetle
- Leafhopper
- Spider mite
- Tarnished plant bug

INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
APHID (typical) Wingless and winged aphids	Adults are ⅛ to ¼ inch long. Color varies: black, brown, red, yellow, pink, white. Body soft, pear shaped, with 2 tubes (cornicles) on back. Mouthparts form a hollow beak on underside of head. Wings, when present, are clear, held rooflike over back. Causes leaf curl, stunting. Devitalizes plants by sucking sap. May transmit plant diseases. Produces honey dew which promotes sooty mold growth.	Several generations a year. Eggs overwinter on woody plants. Females hatch in spring, produce more females without males. Later generations may be winged. Some species migrate to herbaceous plants for summer generations. Fall generation returns to woody plants, males and females mate, females lay overwintering eggs.	Wide range of pesticides available effective for aphid control. Dormant sprays with oil kill overwintering eggs. Because most species feed on new growth, systemic insecticides are very effective. Plants susceptible to aphid-transmitted diseases should be protected.
ARBORVITAE LEAFMINER *(Argyresthia Thuiella)* Larva, adult and damage	Larvae (caterpillars) are minute, 1/5 inch long, body green with black head. Larvae mine in terminal leaves. Mined tips turn brown.	One generation a year. Larvae overwinter in mined terminals. Moths emerge in May and lay eggs on terminals. Eggs hatch in June. Larvae mine in terminals throughout the summer.	Cut off brown tips in winter and destroy them. Use systemic pesticides.
AZALEA CATERPILLAR *(Datana major)*	Young larvae are reddish-brown with white to yellow spots. Full grown larvae are 3 inches long. Body is black with longitudinal rows of yellowish spots and sparse white hairs. Eats leaves of azaleas.	One generation a year. Caterpillars appear in midsummer and become full grown in fall. Larvae feed in groups, all members raising head and posterior in unison when disturbed.	Apply *Bacillus thuringiensis.*

INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
AZALEA LACE BUG *(Stephanitis pyrioides)*  Adult lace bug	Adults are ⅛ inch long. Top of body and wings are membranous, composed of many raised ridges which give lace-like appearance. Suck leaf juices causing serious leaf yellowing and loss of vigor in high populations.	Two generations a year. Eggs overwinter in leaf tissue and hatch in May. Second brood appears in August. Feed on undersurface of leaves. Deposit tar-like fecal spots.	Systemic insecticides most effective. Should spray undersurface of leaves with contact insecticide.
AZALEA LEAFMINER *(Gracillaria azaleella)* Larva, rolled and mined leaf	Full grown caterpillars are ½ inch long, pale yellow. Moths have ½ inch wingspread; front wings are purple and yellow. Anterior end of moth is elevated in resting position. Attacks only azaleas.	Three generations a year outdoors. Larvae overwinter, pupate in spring. Adults lay eggs along midrib on undersides of leaves. Young larvae mine, while old larvae roll ends of leaves and tie them with silk. Pupation occurs on leaves. High populations can build up on azaleas grown in the greenhouse.	Several insecticides are available for outdoor and greenhouse control.
AZALEA WHITEFLY *(Pealuis azalea)*	Eggs are pale yellow; pupae, greenish-white. Adults are white, ⅛ inch long and moth-like.	Several generations a year. Overwinter as immatures. Breeds year-round in the greenhouse, one generation every 40 days.	Use insecticides as labeled.

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INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
BAGWORM *(Thyridopteryx ephemeraeformis)* Bagworm in bag	Caterpillar carries bag (cocoon) and enlarges it to allow for growth. Plant material is built into bag which can become 2 inches long. Adult female is a black, wingless moth. Male adult is 1 inch across wings, black, fuzzy and with almost clear wings.	One generation a year. Eggs overwinter in female bag. Caterpillars appear in late May or early June. In late summer, bag is fastened to a twig and pupa forms inside. Male moths fly to females which remain in bags.	Apply *Bacillus thuringiensis* and use various insecticides *before* mid-June.
BALSAM TWIG APHID *(Mindarus abietinus)*	Pale green, covered with wool-like white wax. Feeds on twigs and needles of fir, spruce and juniper. Needles curl and the bark becomes rough from feeding activity of this aphid.	Several generations a year. Probably overwinters as eggs.	Dormant spray with oil.
BIRCH LEAFMINER *(Fenusa pusilla)* Damage	Mature larvae are ½ inch long, flattened, white with black spots on thorax and first abdominal segment. Adult sawflies are ¼ inch long and black. Larvae eventually mine about ½ of leaf, which turns brown.	Several generations a year. Overwinter as larvae in ground. Pupates in early spring. Adults appear when leaves are ½ open. Eggs are placed in leaves which larvae mine. The first brood causes worst damage.	Systemic insecticides should be applied to leaves when ½ open in spring, or as soon as mines are observed in May.

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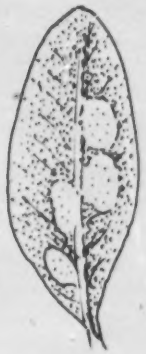
INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
BLACK VINE WEEVIL *(Brachyrhinus sulcatus)* Adult	Adult weevils are between ¼ and ½ inch long, black, with short snout. Back of adult has distinct longitudinal grooves. Larvae are white, D shaped grubs up to ½ inch in length. Most serious on herbaceous greenhouse plants and seedling beds. Outdoors, they prefer yew, rhododendron, azalea, hemlock and other evergreens. Feeding causes notching of leaves.	One generation a year. Overwinter usually as larvae, sometimes as adults in soil. Larvae feed on roots in spring. Adults appear in June. Hide in soil during day; feed at night. Lay eggs in soil in August. Larvae feed in fall, but mostly in spring.	Soil treatment for grubs; foliage treatment for adults.
BOXELDER BUG *(Leptocoris trivittatus)* Adult	Adults are ½ inch long, black, with 3 red stripes on thorax and red on wing veins. Young are smaller and mostly bright red. Suck juices from female pistillate flowers, fruits, foliage and tender twigs of boxelder. May feed on ash, maple and fruit trees. Bothersome in fall since adults will hibernate in buildings.	One generation a year. Adults overwinter and emerge in spring to feed on new foliage. Eggs are laid on leaves, bark and nearby structures. Nymphs mature by late summer.	Remove female boxelder trees from the vicinity of buildings and other host trees such as ash, maple and flowering fruit trees. Certain insecticides may be applied to tree trunks and walls where bugs congregate in the fall.

INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
BOXWOOD LEAFMINER *(Monarthropalpus buxi)*  Damage	Mature maggots are ¼ inch long and orange. Adult flies are light orange gnats about ¼ inch long. Maggots cause blister mine on underside of leaf. Heavy infestation turns leaves yellow.	One generation a year. Overwinters as maggot in leaf mine. Pupates in spring. Adult flies emerge in early May. Eggs inserted in leaf tissue. Maggots mine leaves during summer.	Use insecticides in late May for adults and systemic insecticides in June if mines are observed.
BOXWOOD PSYLLID *(Psylla buxi)* Adult Normal and damaged leaves	Adults are fly-like, 3/16 inch long, light green. Young nymphs are similar in shape but smaller, with shorter wings, and covered with loose, white waxy strands. Feeding activity causes terminal leaves to cup.	One generation a year. Overwinter as nymphs in terminal leaves. Adults appear in late May. Eggs are laid at base of buds. Nymphs hatch, feed and overwinter in terminals.	Use systemic insecticides in May if psyllids are observed.

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INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
BRONZE BIRCH BORER *(Agrilus anxius)* Adult, larva, and emergence hole	Larvae are flatheaded borers, ¾ inch long, white, area just behind head wide and flat. Adult beetles are ½ inch long, black above and coppery beneath. Mine in winding tunnels just under bark causing irregular lumps in bark of infested area. Activities of larvae girdle tree and cause leaves to turn yellow.	Three generations per year. Overwinter as larvae in mine beneath bark. Adult emerges through D shaped emergence hole in bark in May, June and July. Usually attacks birch grown in open, sunny locations. Infestation usually begins in crown of tree and works down.	Recommend white birch be grown only in mountainous, western counties of Maryland. Keep trees vigorous with proper watering, feeding and pruning. Residual insecticides give some protection.
BROWN SOFT SCALE *(Coccus hesperidum)* Brown Soft Scale	Adults are about ⅛ inch long, rather flat, yellowish-brown, often with a dark line down center of back. Young individuals usually resemble the host plant in color. Heavy infestations weaken and stunt plants, and a large amount of honeydew is produced resulting in great sooty mold production. Primarily a pest of foliage plants with smooth leaves.	Does not overwinter outdoors in Maryland. Primarily an indoor pest. One generation is produced every 2 to 3 months. Individuals usually settle along the midrib of terminal leaves.	Adults and young are easily controlled with insecticides if coverage complete. Two sprays are required, 14 days apart, since eggs are not affected by most insecticides.

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INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
CALICO SCALE *(Lecanium cerasorum)* 	Adult females are ¼ inch long, globular, brown with irregular white blotches. Heavy infestations reduce vigor, and may cause dieback of affected branches. Preferred hosts are maple, dogwood and star magnolia.	One generation a year. Overwinter as immatures on bark. Eggs are laid in spring and crawlers appear in mid-June. These spend summer on leaves and move back to twigs in fall.	Dormant spray with oil. In heavy infestations, spray for crawlers June 15 and June 25. See Entomology Leaflet No. 93.
COOLEY SPRUCE GALL APHID *(Adelges cooleyi)* Gall caused by aphid	Minute adult aphids are black, 1 to 2 mm long, with wings longer than body, when present. Forms 2- to 3-inch *terminal* galls on the twigs of many spruces. Does not form galls on Douglas-fir which is the alternate host.	May overwinter as nymph on needles of Douglas-fir or spruces. In spring, nymphs migrate to new growth, form galls on spruces. In midsummer adults on Douglas-fir may migrate to spruces. Galls on spruces open in midsummer to allow adults to escape.	Do not grow Douglas-fir near spruces. Prune out galls before midsummer. Dormant sprays with oil.

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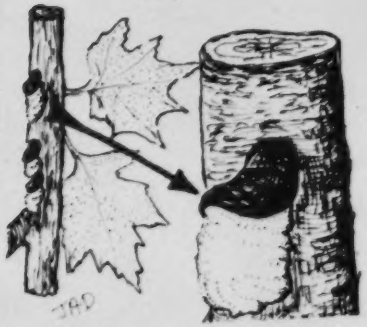
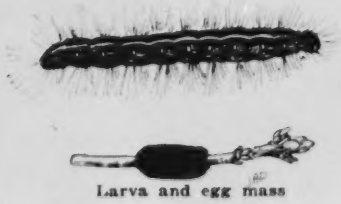
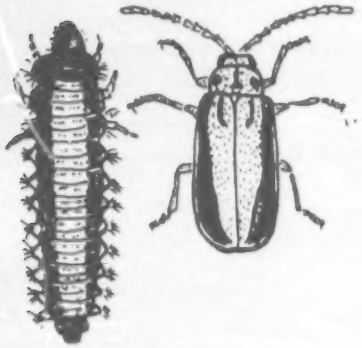
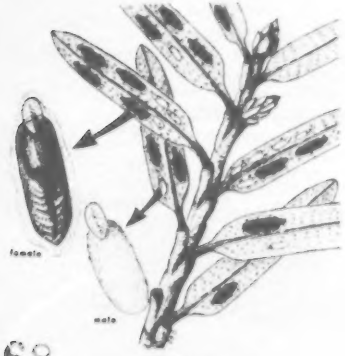
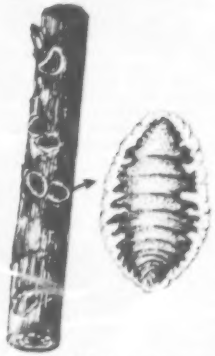
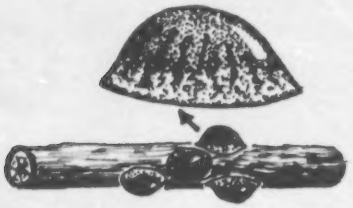
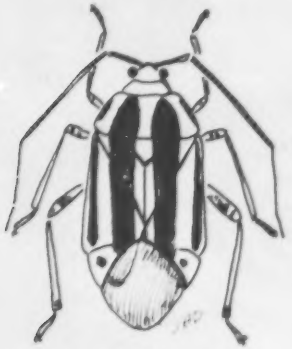
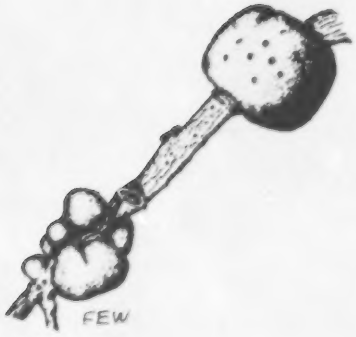
INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
COTTONY MAPLE SCALE *(Pulvinaria innumerabilis)*  Females with egg sacs	Adult females are ¼ inch long, oval, flattened and dark brown. Produces a posterior white ovisac as illustrated. Preferred hosts include maple, dogwood and linden.	One generation a year. Overwinters as immatures on bark. Adult female develops in spring and produces a white ovisac in which the eggs are laid. Eggs hatch in mid-June and young spend summer on leaves and move back to twigs in fall.	Dormant spray with oil. In heavy infestations, use insecticides June 15 and June 25 for crawlers.
CYCLAMEN MITE *(Steneotarsonemus pallidus)* Adult	Too small to be seen readily with the naked eye. About 1/100 inch long, white to tan, slow moving. Serious indoor pest on African violet (stunts new leaves), cyclamen and snapdragon. Serious outdoor pest on delphinium, aconite and snapdragon.	Life cycle completed in 2 weeks indoors, longer outdoors if temperatures are cool. Does not like midsummer heat. Most damage done in spring and late summer outdoors. All stages present on host plants — eggs, larvae and adults.	Apply miticides. Isolate infested plants if possible.
DOGWOOD BORER *(Synanthedon scitula)*	Larva is a white caterpillar, ½ inch long, with brown head. Adult moth metallic blue-black with wings mostly clear. Resembles a wasp.	Larvae overwinter in tree. Adults emerge from May to July. Females usually lay eggs around base of tree near a wound. Prefers trees grown in open, sunny locations. Larva mines in cambium in trunk, sometimes in large branches.	Avoid mechanical injury around base of trunk from mowers. Wrap young trees. Use residual insecticides from spring to midsummer if adult or larval activity observed. Maintain vigor by proper watering, feeding and pruning.

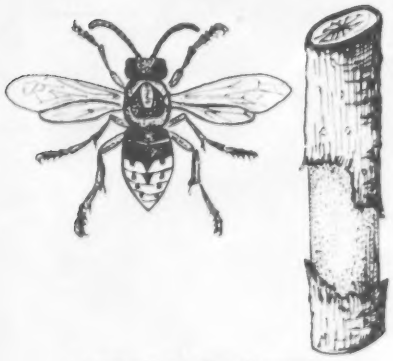
INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
DOGWOOD CLUBGALL MIDGE *(Mycodiplosis clavula)* Gall caused by larva	Larva is an orange maggot about 1/8 inch long. Adult midge is orange to brown. Causes 1 inch long club shaped galls on flowering dogwood. Twigs terminal to galls may die.	One generation a year. Overwinter as pupae in soil. Adults lay eggs in dogwood shoots in May. Galls are completed in summer. Larvae drop from galls in September and burrow in soil.	Prune out developing galls in the summer and destroy them.
EASTERN SPRUCE GALL APHID *(Adelges abietis)* Gall caused by aphid	Adult aphids are minute, about 1 mm, black with long wings. Nymphs are green. Pineapple-like galls, ½ inch to 1 inch long, are formed at *base* of new shoots. Infested branches may die. Prefers Norway spruce; also, attacks white, red, black and Engelmann spruce.	Two generations a year. Nymphs overwinter near terminal buds, feed in spring, mature and lay eggs. Second generation nymphs feed at base of new growth causing gall formation. Galls open in midsummer, adults emerge and produce overwintering generation. They do not have alternate hosts.	Prune out galls before midsummer.
EASTERN TENT CATERPILLAR *(Malacosoma americanum)*  Larva and egg mass	Full grown caterpillar is 2 to 2½ inches long, hairy and black with white stripe down back. High populations defoliate trees. Prefers black cherry, choke cherry and apple, but shade trees may be attacked.	One generation a year. Eggs overwinter in shiny, black, gall-like masses on twigs. Caterpillars appear when wild cherry buds open in spring and build large silken tents in which they stay at night.	Prune out egg masses during winter. Use *Bacillus thuringiensis* or insecticides in May before caterpillars get too large. See Entomology Leaflet No. 21.

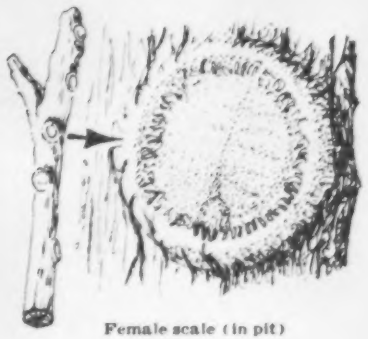
INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
ELM LEAF BEETLE *(Pyrrhalta luteola)*  Larva and adult elm leaf beetle	Adult is ¼ inch long, yellowish, with dark band on margin of each wing cover and black spots on thorax behind head. Mature larva is ½ inch long, yellowish with black side stripes.	Two generations a year. Adults overwinter, usually in buildings. Adults become active when elm leaves unfold. Eggs laid on new leaves. Second generation adults appear in July.	Grow slippery, rock, or winged elm trees since they are relatively resistant. Use insecticides in May if damage is severe. This pest sometimes checked by insect predators.
ELONGATE HEMLOCK SCALE or FIORINIA HEMLOCK SCALE *(Fiorinia externa)*  Scale covers	Adult female is ½ inch long, slender, with parallel sides, light to dark brown. Male cover smaller and white. Heavy infestations give trees whitewashed appearance due to numerous male covers. Can cause premature needle drop and dieback.	Two overlapping generations a year. Both sexes always found on ventral surface of needles oriented lengthways on each side of midrib. Crawlers most abundant in May and July.	Use systemic insecticides. See Entomology Leaflet No. 81.

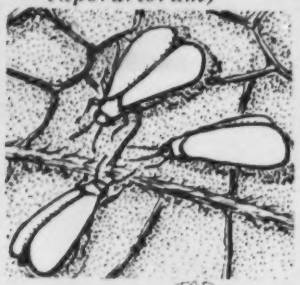
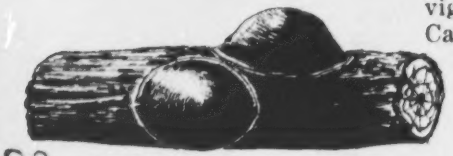
INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
EUONYMUS SCALE *(Unaspis Euonymi)* Scale covers	Adult female's cover is ⅛ inch long, broadly oyster-shell shaped, dark brown. Male cover is smaller, elongate, white with 3 longitudinal ridges. A serious pest of most *Euonymus* species also found on *Celastrus* and *Pachysandra*. Heavy infestations cause leaf drop, dieback, and eventually death of host plants.	Three overlapping generations a year. Overwinter as adult females. Eggs are laid in early spring. Crawlers most abundant in May, July and August. Found mainly on bark. Males may become abundant on leaves in heavy infestations.	Recommend *Euonymus japonicus* not be planted. *E. alatus* appears resistant. Dormant oil sprays. In heavy infestations, use insecticides May 10 and 20, then again July 10 and 20 for crawlers. See Entomology Leaflet No. 48.
EUROPEAN ELM SCALE *(Gossyparia spuria)*  Adult females	Adult female is ⅛ inch long, dark brown, with fringe of white wax around margin. Usually found in forks of twigs.	One generation a year. Overwinter as immatures on bark. Adults appear when fruit forms. Egg laying begins 3 weeks after leaves open and continues into August. Eggs hatch shortly after being laid. Young summer on leaves and go to branches in fall.	Dormant sprays with oil.

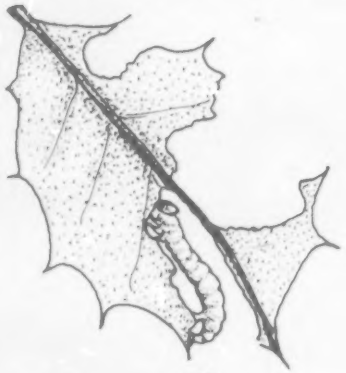
INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
EUROPEAN FRUIT LECANIUM *(Lecanium corni)*  Adult female	Adult female is ¼ inch long, brown, oval in dorsal view and convex in lateral view. Heavy infestations cause loss of vigor and dieback.	One generation a year. Overwinter as immatures on bark. Adult females hump up in spring and lay eggs under their bodies. Crawlers appear around mid-June, spend summer on leaves and return to bark in fall.	Dormant sprays with oil. In heavy infestations, use insecticides June 15 and 25 for crawlers.
FALL CANKERWORM *(Alsophila pometaria)* 	Adult female moth is ½ inch long, wingless and gray. Adult male moth is brownish-gray. Caterpillar is 1 inch long with 3 pairs of prolegs on abdomen, gray with 3 pairs of yellowish stripes on sides. Defoliates many kinds of trees when abundant.	One generation a year. Spend summer in ground as pupae. Adults emerge in fall *after* freezing temperatures occur. Females climb trees, mate and lay eggs on bark. Caterpillars appear when leaves open in spring, mature in June and drop to ground to form pupa.	Apply *Bacillus thuringiensis.*
FALL WEBWORM *(Hyphantria cunea)*	Adult moth has a ½ inch wingspread and is white with brown spots. Caterpillar is pale greenish-yellow with black stripe down back. Body covered with long, silky, gray hairs.	Two generations a year. Overwinter in cocoons under bark and in litter on ground. First generation caterpillars appear in May and June; second appear in August and September. Caterpillars *enclose* leaves at ends of branches within a silken tent and feed within the tent.	Prune out tents in isolated cases. Use insecticides only if infestations are widely spread and damage likely to be severe before mid-August. Apply *Bacillus thuringiensis.*
FIORINIA HEMLOCK SCALE	(See ELONGATE HEMLOCK SCALE)		

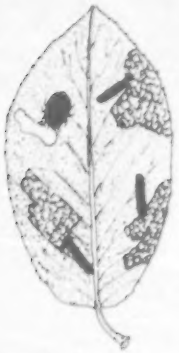
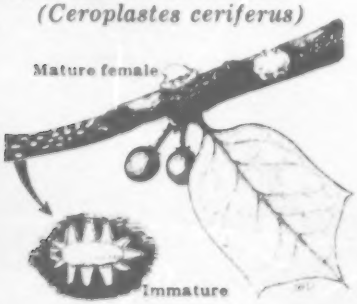
INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
FOURLINED PLANT BUG *(Poecilocapsus lineatus)*  Adult	Adults are ¼ inch long, greenish-yellow with 4 black stripes down the wings. Nymphs are smaller, bright red with black dots on thorax and wings reduced to short pads. Feed mainly on leaves of flowers and shrubs. Suck sap and cause round, white to reddish - black spots on leaves.	One generation a year. Eggs overwinter in plant tissues. Hatch in May. Adults appear in early summer. Feeding damage at peak from late June to mid-July.	Use insecticides when nymphs appear in spring on leaves.
GALLS  	Galls are plant swellings usually caused by wasp or fly larvae, or eriophyid mites.	Little is known about the life cycles of gall forming insects but most overwinter in the galls. Most species attack the leaves, twigs or small branches of oaks.	Leaf galls are not serious. Twig and branch galls can be pruned out during the winter. See Entomology Leaflet No. 31.

INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
GARDEN FLEAHOPPER *(Halticus bractatus)* Adult	Adults are ⅛ inch long, resemble small, black aphids, with antennae longer than body and hind legs adapted for jumping-like flea beetles. Cause small white spots on leaves by sucking out juices. May kill leaves if abundant.	Up to 5 generations per year. Overwinter as adults in litter. Feed on a great variety of vegetables and flowers.	Weeds should be controlled near flower beds. Insecticides are available for control.
GIANT HORNET *(Vespa crabro germana)*  Adult and girdling damage	Largest hornet in U.S. Adult is 1 inch long. Body is reddish-brown with orange marks on abdomen. Girdles twigs and branches of lilac, birch, willow and other trees and shrubs.	One generation a year. Most damage occurs in August and September.	When hornet girdling is observed, spray branches with an insecticide.

INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
GLOOMY SCALE *(Melanaspis tenebricosa)* Scale covers	Adult female's cover is convex, circular, 1/8 inch in diameter and dark gray. Male's cover is similar in color and texture but smaller and elongate. Heavy infestations cause loss of vigor and dieback.	One generation a year. Immatures overwinter. Adult females lay eggs in spring. Crawlers appear in early July.	Dormant sprays with oil.
GOLDEN OAK SCALE *(Asterolecanium variolosum)*  Female scale (in pit)	These pit scale adult females are 1/8 inch long, circular, flattened, shiny and yellow to gold. If pit formation is abundant, twigs are deformed and may dieback.	One generation a year. Adult females overwinter. Eggs are laid in spring. Crawlers appear in late-May to mid-July. These develop to adults by fall. Feeding causes a circular pit to form on bark around pit scale.	Dormant spray with oil. Use insecticide when crawlers appear May 15 and June 1 if infestation is severe.

INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
GREENHOUSE WHITEFLY *(Trialeurodes vaporariorum)*  Adult	Adult females and males are 1/16 inch long, white and moth-like. Immatures have flattened disks without appendages which stick to the undersides of leaves. High populations cause wilting, yellowing and large amounts of honeydew. Attacks a wide variety of flowers, foliage plants, shrubs and vegetables.	Does not overwinter outdoors in Maryland. Carried through the winter on greenhouse plants. Usually infests homes and gardens from infested greenhouse stock, especially bedding plants sold in spring. Depending on the temperature, there may be 6 to 8 overlapping generations a year in the greenhouse and 3 to 4 outdoors in the summer.	Spray every 10 days with a pyrethrin type insecticide until adults are no longer observed. Systemic insecticides are valuable if plants are not to be sold immediately.
GREENSTRIPED MAPLEWORM *(Anisota rubicunda)* Greenstriped mapleworm	Mature caterpillar is 1½ inches long, light green, striped with 8 light and 7 dark green lines, and the bottom of the next to the last 2 abdominal segments is pink. They also have 2 "horns" on thorax, 2 rows of spines on each side of body and 4 large spines near posterior end. Adult moths are 1½ to 2 inches across wings and pale yellow with rose-colored bands. Defoliates when abundant. Attacks maples, oaks and boxelders.	Two generations a year. Overwinter in cocoons. Caterpillars appear in May and June, adults in June and July. Second generation caterpillars appear in August and September, and form cocoons to overwinter.	Use insecticides while caterpillars are young.
HEMISPHERICAL SCALE *(Saissetia coffeae)*  Adult female	Adult female is ¼ inch long, oval, highly convex and shiny brown to black. Prefers foliage plants which are not fuzzy. Feeding causes loss of vigor and eventual plant death. Causes development of sooty mold.	Does not overwinter outdoors in Maryland. May have 4 or more generations a year in the greenhouse.	A wide range of labeled pesticides give good control of all but egg stage.

INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
HOLLY LEAFMINER *(Phytomyza* spp.) Damage by larvae	Maggot is 1/8 inch long and yellowish. Adult fly is 1/16 inch long and black. Females puncture leaves to feed and lay eggs. Maggots mine leaves.	One generation a year. Maggots overwinter in mines. Adults appear last 2 weeks of April and mate. Females oviposit in leaves. Maggots mine through summer in leaves. Attack mainly American and sometime English holly.	Spray systemic insecticides May 25. See Entomology Leaflet No. 22.
HOLLY LOOPER *(Thysanopyga intracta)* 	Mature caterpillar is 3/4 inch long and is light green similar to holly leaves. This is a looper and moves in typical inch worm fashion. Feeds mainly on American holly in the central, southern and eastern parts of the state. Most damage occurs in the fall.	Probably does not overwinter in Maryland. Believed to migrate north from the south. Probably does not arrive in Maryland until midsummer.	No insecticides are labeled for this insect.

INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
IMPORTED WILLOW LEAF BEETLE *(Plagiodera versicolora)*  Adult and larvae with damage	Adult beetles are 3/16 inch long and are shiny metallic blue. Similar in shape to a flea beetle. Larvae slug-like, bluish-black. Larvae skeletonize lower leaf surface. Adults eat holes in top of leaf. Prefer weeping willow, but attack all willows and occasionally lombardy poplar.	Three generations a year. Adults overwinter under bark. Emerge and lay eggs in early May. First generation adults appear in late May.	Use insecticides in mid-May.
INDIAN WAX SCALE *(Ceroplastes ceriferus)* 	Adult female is red but covered by white wax. Length including wax is ¼ to ½ inch. Immature stages with tufts of white wax as illustrated. Preferred hosts include holly, hemlock and spirea. Heavy infestations cause loss of vigor and dieback.	One generation a year. Overwinter as mature females attached to bark of host. Eggs are laid in spring and hatch in mid-June.	Handpick small infestations in winter. Spray heavy infestations with insecticides June 15 and 25 to kill crawlers. See Entomology Leaflet No. 16.
IRIS BORER *(Macronoctua onusta)*	Mature caterpillar is 1 to 2 inches long, flesh colored with brown head. Most destructive iris pest. Prefers German, Japanese and native blue flag iris. Bores in rhizomes and may cause a soft rot.	One generation a year. Overwinter as eggs on old iris leaves, etc. Hatch in April, bore into and down leaves into rhizomes. Feeds until July, then pupates in soil. Adult moths appear August to October and fly at night and lay eggs on leaves.	Cleanup and dispose of old iris leaves, etc. in autumn. Use insecticides in spring if boring damage is noted.

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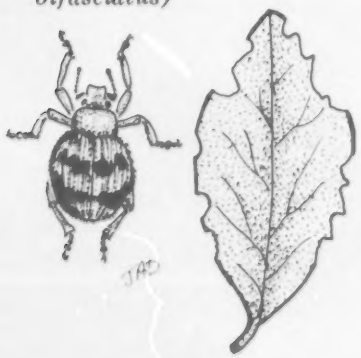
INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
JAPANESE BEETLE *(Popillia japonica)* Adult	Adult is ½ inch long, metallic green with brownish wing covers. Larva is a ¾ inch long, C shaped white grub.	One generation a year. Overwinter in soil as white grubs. Adults appear late June to August with peak abundance in July. Eggs are laid in sod. Larvae eat grass roots; adults may prefer flower heads.	Milky spore disease for grub control. See Entomology Leaflet No. 78.
JAPANESE MAPLE SCALE *(Lopholeucaspis japonica)*	Adult female is ½ inch long, oyster-shell-shaped wax cover, thin and white to gray. Male cover is smaller and white. Prefers maples and pyracantha. Causes dieback and eventual plant death.	Two generations a year. Crawlers appear June to July and again in September.	Spray with dormant oil. Use insecticide sprays June 10 and June 20, and September 10 and 20 for crawlers.
JAPANESE WEEVIL *(Pseudocneorhinus bifasciatus)*  Adult and damage	Adult is ¼ inch long, tan with 2 irregular dark bands across wing covers. Larva is ½ inch long, white and a legless grub. Grubs eat roots; adults notch margins of leaves.	One generation a year. Overwinter as white grubs in soil. Adults are present from late June to September. This species cannot fly. It prefers privet but will feed on many shrubs and flowers.	Soil treatment for grubs. Residual insecticides on foliage for adults.

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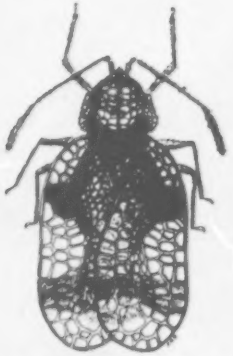
INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
JUNIPER WEBWORM *(Dichomeris marginella)* Larva and adult	Larva is 3/8 inch long, light brown, with 3 reddish-brown stripes down the back.	One generation a year. Overwinter as partly grown larvae in silk cases in webbed foliage. They feed in early spring. Adult moths appear in June and July.	Spray systemic insecticides in March or April on a mild day.
LACE BUG  Typical adult lace bug	Adults are 1/8 to 1/4 inch long, front wings are lace-like in appearance and head is covered by a lace-like hood. Nymphs are smaller, dark and spiny. Feeding results in loss of chlorophyll and leaves turn yellow. Most serious on shrubs such as azalea, rhododendron and andromeda. Present on many trees.	Two to five generations a year. Overwinter as eggs in terminal buds. Eggs hatch in May. All stages feed on undersides of leaves. They also deposit characteristic black fecal spots on undersides of leaves.	Systemic insecticides work best. Contact insecticides work if sprayed on undersurface of leaves. Spray when lace bugs are seen in late May. See Entomology Leaflet No. 95.

INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
LEAFHOPPER Adult	Adults are 1/8 to 1/4 inch long, wedge shaped and hind legs with rows of spines. Feeding causes stippling and can cause stunting. Large amount of honeydew is produced. Some species transmit plant diseases.	Four or five generations a year. Overwinter as eggs. Eggs hatch when flowers and tree leaves unfurl in spring.	Use systemic insecticides when observed.
LILAC BORER *(Podosesia syringae)* Adult	Larva is a white caterpillar with brown head, 3/4 to 1 1/2 inches long. Adult is a wasp-like moth with brown fore wings and transparent hind wings with 1 1/2 inch wingspread. Bores in lilac, ash and privet.	One generation a year. Overwinter as caterpillars in trunk, usually near ground. Adult moths appear in May and June. Eggs are laid on bark near ground, especially near wounds.	Residual insecticides once a month in May and June. Maintain vigor by proper watering, feeding and pruning. Prevent wounding with mowers.

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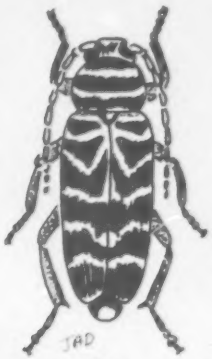
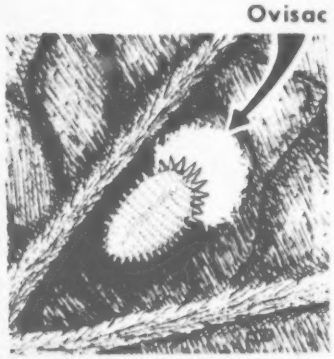
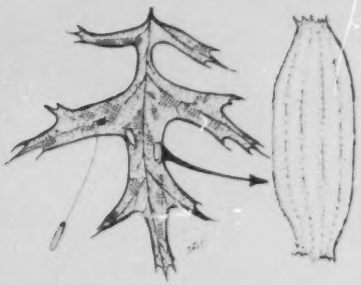
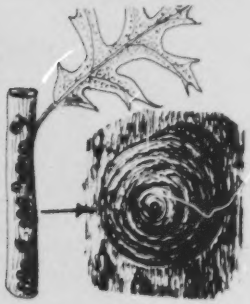
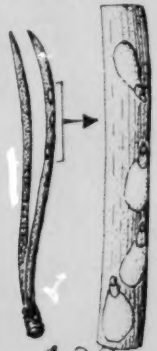
INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
LOCUST BORER *(Xenochalepus dorsalis)*  Adult	Larva is a ½ to 1 inch long, white roundheaded borer. Adult beetle is ½ to ¾ inches long, black with yellow cross bands and long antennae. Bores in black and yellow locust.	One generation a year. Overwinter as larvae in trunk and larger branches. Adults appear in August and September. They feed on goldenrod in the morning and visit locust trees in the afternoon. In sunny locations trees under 6 inches in diameter are preferred.	Residual insecticides on bark in September. Maintain vigor by proper watering, feeding and pruning. Do not plant in sunny, exposed locations.
LOCUST LEAFMINER *(Xenochalepus dorsalis)* Adult	Adult beetle is ¼ inch long, wedge shaped, orange-yellow, with black stripe down middle of back; head and appendages are black. Larva is yellowish-white with black head. Larvae feed in a common blotch-type mine. Heavy infestations turn leaves brown in midsummer.	One or two generations a year. Overwinter as adults. Lay eggs on locust leaves as they unfurl. Larvae form blotch mines. Feeds mainly on black locust.	Trees tolerate damage well. Control not recommended unless damage is severe early in the season. Damage after midsummer usually not serious. Use systemic insecticides for control.

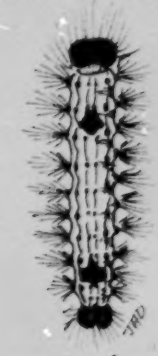
INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
MAPLE BLADDERGALL MITE *(Vasates quadripedes)* Adult	All stages barely visible to unaided eye. Mites cigar shaped with 4 anterior legs. Cause circular galls less than ¼ inch long on upper leaf surface. Galls turn from red to green to black. Galls do not seriously affect trees.	Two generations a year. Overwinter on bark as adults. These move to leaves as they open in spring.	Control not recommended. See Entomology Leaflet No. 31.
MEALYBUG Citrus mealybug *(Planococcus citri)*  Adult female	This is the most common mealybug found indoors in Maryland. Adult females of most species grow to 3/16 inch in length, oval and covered with dusty, white wax. Margins with white, waxy tufts. Adult female produces white cotton-like ovisac in which eggs are laid. Causes sooty-mold development, stunting and eventual death of untreated plants. Prefers coleus and citrus but feeds on most plants.	Citrus mealybugs usually do not overwinter outdoors in Maryland. In the greenhouse, there may be 6 or more overlapping generations a year.	Use systemic insecticides.

INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
MIMOSA WEBWORM *(Homadgula anisocentra)* Adult and damage	Caterpillar is ½ inch long and dark brown. Moth has a ½ inch wingspread and is silver-gray. Usually eats only undersurface of leaves, which later turn brown.	Two generations a year. Overwinter as pupae in soil. Moths lay eggs on leaves of mimosa and honey locust in June. Larvae feed together in a web spun around leaves. Mature larvae feed singly on leaves and green pods. Second generation appears in August.	Use insecticides in June and August if damage is observed.
MOUNTAIN ASH SAWFLY *(Pristiphora geniculata)*	Larva is ¾ inch long and green with black spots. Adult is ½ inch long and yellow with black spots. Feeds mainly on upper leaves. Eats everything but midrib and petiole.	One generation a year. Overwinter in cocoons in soil. Adults lay eggs in leaves in May. Larvae feed from June to mid-July.	Use insecticides if defoliation is serious.
NANTUCKET PINE TIP MOTH *(Rhyacionia frustrana)* Damage by larva	Caterpillar is ⅜ inch long, yellowish-brown. Moth with ½ inch wingspread, is mottled brown and white. Feeds in terminals of most 2- and 3-needle pines. Does not attack white pine. Prefers trees under 15 feet in sunny locations.	Two generations a year. Overwinter in pine terminals. Adults appear in spring. Lay eggs on needles of terminals. Larvae burrow into tips which turn brown. Second generation appears in August.	Use systemic insecticides in late March on the eastern shore, late April in central Maryland and mid-May in western Maryland. Pupal skins protruding from pine tips indicate that adults will emerge. Sprays should be applied 2 weeks later. See Entomology Leaflet No. 87.

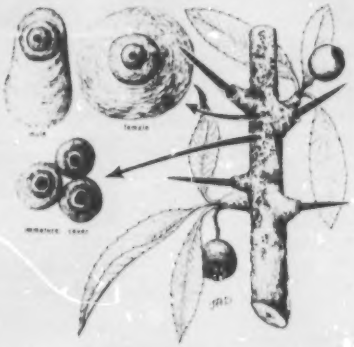
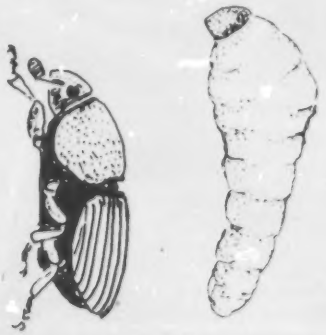
INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
OAK SKELETONIZER *(Bucculatrix ainsliella)*  Larva, damage and cocoon	Caterpillar is ¼ inch long and yellowish-green. Skeletonizes top surface of leaves. Prefers red, black and white oak.	Three generations a year. Overwinter in tiny white cocoons on fallen leaves, bark, etc. Larvae active in May, July, September through October. Larvae drop on silken threads in October to seek overwintering sites.	Control is not recommended. Damage is usually not severe until late fall.
OBSCURE SCALE *(Melanaspis obscura)*  Female scale covers	Adult female's cover is circular, ⅛ inch in diameter, gray to black. Male's cover is smaller, elongated and similar in texture and color. Found on most oaks. Most serious on pin oak and willow oak. In dry years, high populations cause dieback of branches.	One generation a year. Overwinter as immatures. Crawlers appear in mid-July on red oaks and mid-August on white oaks.	Dormant spray with oil. See Entomology Leaflet No. 52.
ORANGESTRIPED OAKWORM *(Anisota senatoric)*	Caterpillar is 2½ inches long, black with yellowish-orange longitudinal stripes and black "horns" at end of body. When present in high populations defoliates trees. Prefers white and scrub oaks.	One generation a year. Overwinter as pupae in soil. Adults appear in June and lay eggs on host trees. Larvae most noticeable in late summer.	Use insecticides when population is high.

INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
OYSTERSHELL SCALE *(Lepidosaphes ulmi)* Scale covers	Adult female's cover is oyster-shell shaped, 1/8 inch long and brown to gray. Male's cover is similar but smaller. Prefers fruit trees, willow, poplar, maple, boxwood and lilac. High populations cause dieback of branches.	Two generations a year. Crawlers appear in May and July.	Spray with dormant oil. Spray with insecticides May 10 and 20, and July 15 and 25 for crawlers if damage is severe. See Entomology Leaflet No. 84.
PALES WEEVIL *(Hylobius pales)* Adult	Larva is a 1/2 inch long grub, white with brown head and is legless. Adult is 1/3 inch long, brown to black, with light speckles on head and thorax. Pest appears in Christmas tree plantings. Usually girdles at ground level seedlings less than 2 feet tall. Prefers white pine but attacks other conifers.	One generation a year. Adults overwinter in soil litter. Eggs are laid in fresh logs and stumps in April and May. Larvae feed in stumps over summer. Adults appear in late summer and attack seedlings.	Use residual insecticides in April. Remove stumps of cut pines.

INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
PEACHTREE BORER *(Sanninoidea exitiosa)* Larva and adult male	Adult female moth is wasp-like, with 1 inch long wingspread, blue-black with clear, hind wings and narrow, yellow bands on the abdomen. Larva is 1 inch long, grub-like, white with brown head.	One generation a year. Overwinter as larvae in tree burrows — usually from 3 inches below ground to 12 inches above. Adults appear in spring and early summer and lay eggs near ground around wounds or rough bark.	Wrap young trees. Keep trees vigorous with watering and fertilizer. Spray with residual insecticides once a month, May to September.
PINE BARK APHID *(Pineus strobi)*	Adult is ⅛ inch long, black and usually covered by white wax. Nymphs are smaller and also wax covered. Not a serious pest but it does give pine trunks and branches an ugly, whitewashed appearance. Prefers white pine but other pines attacked.	Two generations a year. Nymphs overwinter under white wax on pines. Adults appear in April and lay eggs. These produce adults in summer which may fly to other pines. These produce the fall generation which overwinters.	Dormant spray with oil.
PINE NEEDLE SCALE *(Chionaspis pinifoliae)*  Scale covers	Adult female's cover is ⅛ inch long, white, slender, oyster-shell shaped. Male's cover is similar but smaller. Found on pines, spruce and fir. Heavy infestations cause yellowing of needles.	Two generations a year. All stages occur on the needles. Crawlers appear in May and July.	Spray with dormant oil. Small trees may be sprayed with insecticides May 15 and 25, and July 10 and 20 for crawler control.

INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
POPLAR TENTMAKER *(Icthyura inclusa)*  Caterpillar	Mature caterpillar is 1¼ inches long, gray, striped, with a pair of black tubercles on abdominal segments 1 and 8. Moths have a 1 inch wingspread and are gray with 3 white lines bordered with red on outer edge of wings. May defoliate poplar and willow when abundant.	Two generations a year. Overwinter in cocoons on ground. Caterpillars may be present from May to October. Larvae build silken tents in leaves. Prefer to attack small groups of trees growing in the open.	Use insecticides as labeled.
REDHEADED PINE SAWFLY *(Neodiprion lecontei)* Larva	Larva is caterpillar-like, 1 inch long, white with black spots and reddish-brown head.	Two generations a year. Overwinter as mature larvae in cocoons in soil. Adults appear in spring and lay eggs in needles. Larvae are present in spring and late summer.	Use insecticide while larvae are small.
REDHUMPED OAKWORM *(Symmerista albifrons)* Caterpillar	Caterpillars are 1 to 2 inches long, green when young, later yellowish with many fine, longitudinal black lines and a red hump on top. Prefers oak but also feeds on beech, elm and maple leaves.	One generation a year. Pupae overwinter in soil. Larvae most abundant in July and August.	Apply *Bacillus thuringiensis*.

INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
ROSE MIDGE *(Dasineura rhodophaga)* Adult, larva and damage	Adult fly is 1/20 inch long, yellowish-brown. Maggots are 1/12 inch long and white. Attacks only roses.	Three or more generations a year. Probably overwinter as pupae in soil. Adults usually not observed until midsummer. Females lay eggs on buds; maggots bore into buds and cause them to blacken and die. Life cycle takes 2 weeks in greenhouse.	Use systemic insecticides as soil or leaf treatments.
SADDLED PROMINENT *(Heterocampa guttivitta)* Caterpillar	Caterpillar is 2 to 3 inches long and green to yellowish-brown with a reddish-brown saddle in the middle of the back. Prefers beech, sugar maple and apple. Also attacks other maples, oak and poplar.	One generation a year. Caterpillars most abundant in July and August.	Use insecticides when population is high.

INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
SAN JOSE SCALE *(Quadraspidiotus perniciosus)*  Scale covers	Adult female's cover is circular, 1/8 inch in diameter and gray. Male's cover is smaller, elongate and similar in color and texture. Prefers fruit trees and pyracantha. Produces toxins which cause dieback.	Three generations a year. Crawlers appear in June, July and September.	Use dormant spray with oil. In heavy population, use insecticides in mid-June, mid-July and mid-September for crawler control. See Entomology Leaflet No. 11.
SMALLER EUROPEAN ELM BARK BEETLE *(Scolytus multistriatus)*  Adult and larva	Adult beetle is 1/8 inch long, brown to black with a tooth-like projection on ventral surface and head is bent strongly downward. Larva is a 1/4 inch long white grub, slightly curved and largest at the head end. Adults inoculate elm trees with spores of the Dutch Elm disease fungus when they feed. A most serious disease on American elm.	Two generations a year. Larvae overwinter in galleries under elm bark. Adults appear in May, June, July and August. They first feed on bark in the tops of trees. They then fly to diseased and dying trees, form tunnels under the bark and lay eggs. Larvae feed and make their own tunnels at right angles from the female tunnel.	Control of elm bark beetles and Dutch elm disease is complicated and expensive. Contact a licensed Maryland arborist for help. Dying trees should be cut down and disposed of to remove breeding sites. Plant resistant elms instead of the American elm.

INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
SOUTHERN PINE BEETLE *(Dendroctonus frontalis)* Adult	Adult beetles are 3/16 inch long and are brown to black. Larvae are small, white grubs. Prefer pines but may attack spruces. Prefer weak trees and mature trees. Worse in dry years.	Three generations a year. Usually overwinter as larvae in galleries under bark. Main tunnel of gallery is S shaped. Adults appear in May and seek weak trees.	Keep trees growing vigorously. Spray bark of stressed trees with residual insecticides.
SPIDER MITES Twospotted spider mite, Southern red mite, Spruce spider mite and others. Adult	Adult females are less than 1/50 inch long, spider-like with 8 legs and no antennae. Color varies from white to red to black. Feeding causes stippling and eventually browning of heavily infested leaves.	Most species overwinter as eggs on bark. Twospotted spidermites overwinter as adults. Feeding begins early in spring. Damage on conifers may occur in April and May. Deciduous trees may suffer mite damage in midsummer.	In winter, use dormant sprays with oil. Use miticides in summer when damage occurs.

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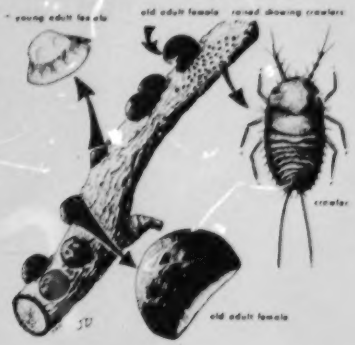
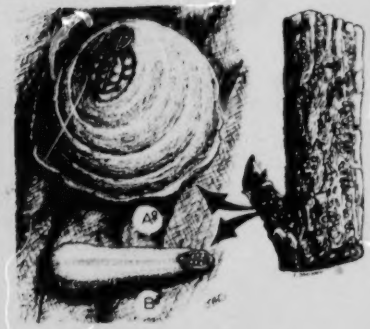
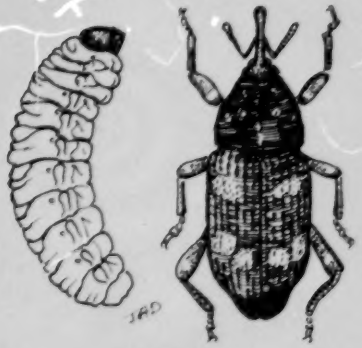
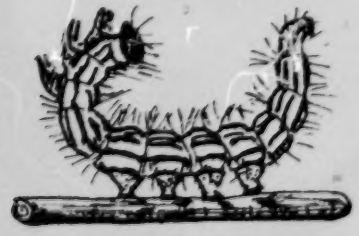
INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
SPRING CANKERWORM *(Palecrita vernata)*	Adult female moth is wingless, ½ inch long and gray with black stripe down back. Adult male moth is silky, gray with 3 black lines across each front wing. Caterpillar is 1 inch long, varving from green to brown on each side and only 2 pairs of prolegs on abdomen. A serious defoliator when abundant. Feeds on many trees.	One generation a year. Spend early winter in ground as pupae. Adults appear in February or March. Females climb trees and lay eggs on bark. Eggs hatch when leaves unfold in spring.	Apply *Bacillus thuringiensis.*
TARNISHED PLANT BUG *(Lygus lineolaris)*	Adult is ¼ inch long and is brownish with yellow, white and black blotches. Flowers, especially dahlias and asters are preferred; most others are also attacked. Feeding toxins often cause stunting and deformed flower buds.	Three to five generations a year. Overwinter as adults in weeds, trash, etc. Adults fly to feed on fruit tree buds in spring and later they fly to other plants to lay eggs in flowers and leaves.	Remove overwintering sites of weeds, trash, etc. Use insecticide when buds form if bugs are present.
TAXUS MEALYBUG *(Dysmicoccus wistariae)*	Adult female is 3/16 inch long, covered with white wax except for 4 stripes down back. Heavy infestations cause much sooty mold and will cause dieback to taxus.	Two or three generations a year. Crawlers overwinter on bark.	Dormant spray with oil. Use insecticides whenever populations are found in summer.
TERRAPIN SCALE *(Lecanium nigrofasciatum)*	Adult female is 3/16 inch long, convex, dark reddish-brown with 10 or 12 black bands radiating out from the center. Prefers maples and fruit trees. Heavy infestations cause dieback.	Adult females overwinter on twigs. Eggs are laid in spring and crawlers appear in mid-June. They summer on leaves and return to twigs in late summer, mature, mate with males and overwinter.	Dormant spray with oil. Use insecticides in mid-June for crawlers.

INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
THRIPS Adult	Adults are about ½ to ⅛ inch long and may be white, yellow, brown or black. Wings are narrow struts fringed with long hairs. Immatures are similar but lack full length wings. Damage is caused by the way they scrape plant tissues with their mouthparts. This causes a streaking of leaves and flowers.	Many species complete a generation in 2 to 4 weeks in the summer and under greenhouse conditions. They usually prefer flower heads.	Apply insecticides as labeled when populations build up.
TULIPTREE SCALE *(Toumeyella liriodendri)* 	Adult female is ¼ inch long, oval, highly convex and pink to gray. Prefers tulip tree and magnolia. Heavy infestations cause dieback.	One generation a year. Overwinter as immatures. Adults appear in June. Eggs are laid in August. Crawlers appear in late August, September and early October.	Dormant spray with oil. Use insecticides September 15 and 25 for crawlers.
TWIG GIRDLER *(Oncideres cingulata)* Adult and damage	Adult beetle is ½ inch long and gray. Larva is ¾ inch long and white with a brown head. Girdling activity may cause serious damage to young trees. Prefers hickory, pecan, persimmon, oak, poplar, sourgum and honey locust.	Overwinter in twigs on ground as a larva. Pupation occurs in spring. In late summer, adult beetles lay eggs in twigs and then drop them to the ground by girdling.	Rake up and destroy severed twigs in fall.

INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
TWIG PRUNER *(Elaphidionoides villosus)* Larva and adult	Adult beetle is ½ inch long, narrow and brown. Larva is ¾ inch long and white with a dark head. Larva prunes twigs from trees by chewing from the inside. Prefers oak, hickory, pecan, maple, locust, elm, walnut and fruit trees.	Larvae overwinter in pruned twigs on ground. Adults appear when oak leaves unfurl in spring. Eggs are laid in leaf axils of terminal twigs. Larvae bore into twigs. In late summer, they prune the twigs in which they feed.	Rake up and destroy severed twigs in fall.
WALNUT CATERPILLAR *(Datana integerrima)*	Caterpillar is 2 inches long and black with white stripes and long white hairs. Prefers walnut, butternut, hickory and pecan.	One generation a year. Overwinter as pupae in cocoons in soil. Adults emerge in June. Larvae are present in June and July. Larvae are gregarious and migrate to trunk where they molt in a cluster.	Use insecticides when damage occurs.
WHITE PEACH SCALE *(Pseudaulacaspis pentagona)*  Scale covers	Adult female's cover is circular, ⅛ inch in diameter and white. Male's cover is smaller, elongate and white. Prefers *Callicarpa, Prunus* and *Melia*. Heavy infestations cause dieback.	Three generations a year. Crawlers appear May, July and August.	Dormant spray with oil. In heavy populations, use insecticides in mid-May, mid-July, and late August for crawlers.

INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
WHITE PINE APHID *(Cinara strobi)* 	Adults are ¼ inch long, black with white spots on back. Feeds on twigs and branches of white pine.	Several generations a year. Most abundant in spring and fall. Overwinter as black eggs in rows on white pine needles.	Dormant spray with oil, various insecticides.
WHITE PINE WEEVIL *(Pissodes strobi)*  Larva and adult	Adult beetles are ¼ inch long, reddish-brown with white spots. Larvae are legless white grubs and measure ¼ inch long. Larvae kill terminals which wilt by mid-July. Most serious white pine pest in the East.	One generation a year. Adults overwinter on ground. They become active in April and May. Eggs are laid in white pine leaders in May.	Prune infested terminals in July. Spray terminals with residual insecticides in late April.
YELLOWNECKED CATERPILLAR *(Datana ministra)* 	Caterpillar is 2 to 3 inches long, black with 8 yellow stripes and a yellow "neck" thorax. Prefers fruit trees. Also attacks beech, birch, hickory, linden, oak, walnut and other trees.	One generation a year. Overwinter as pupae in soil. Larvae do the most damage in August. Larvae are gregarious and raise both ends when disturbed.	Use insecticides when populations are high.

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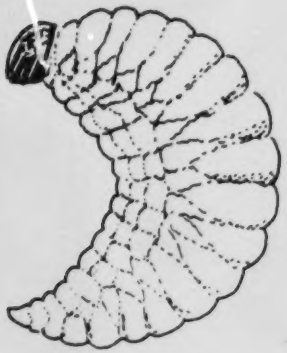
INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
BLUEGRASS BILLBUG *(Sphenophorus parvulus)*	Adult: A weevil about ¼ inch long, black or dark brown with a long "snout". Injury caused by adults is much less important than that caused by the larval stage. Feeding injury appears as small puncture wounds in the grass stems or a "ragging" of the newly emerging grass blades. Larva: A legless, white to cream colored grub with a brown head. Early season injury, caused by the small grub feeding inside the grass stem, will appear in the turf as small round, brown patches usually 1 to 4 inches in diameter. These dead patches are easily pulled out from the thatch. Young larvae feed inside the grass stems, hollowing out the stem and crown, leaving very fine sawdust-like excrement inside. Larger larvae feed on roots below the thatch layer. This type of feeding is identical to that caused by the Japanese beetle grub.	In Maryland, there is usually one generation per year. The adult weevils overwinter in the thatch and become active between March and May. Eggs are laid inside the stems. The young larvae feed inside, killing stem, then exit through the crown into the soil during June. The greatest damage by the larvae occurs from early July to early September. Where grass is killed, the thatch appears loose and is easily lifted from the soil. The billbugs pupate from late August into September. The adults are active for a short period from September to the end of October.	Adult: Control of this pest is difficult once the eggs have been laid inside the grass stems. Best time to apply controls is late April to late May to kill the overwintering adults before they lay eggs. Grub: Application of insecticides for grub control during July, August and September may or may not provide good control. Optimum effectiveness is usually achieved only by following the insecticide application with 1 to 2 inches of water in order to flush the material into the top 2 to 3 inches of soil. If grub infestations are light to moderate (1 to 2 grubs per square foot), it is probably best not to apply an insecticide but only water and fertilize to stimulate new growth. Refer to Entomology Leaflets Nos. 75 or 30.

Adult billbug



Billbug larva

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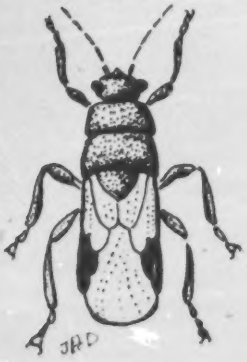
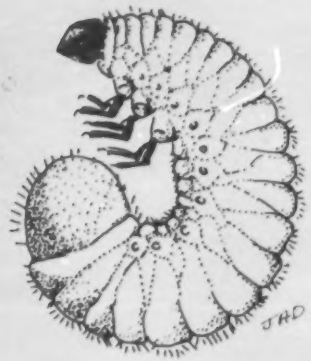
INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
CHINCH BUG *(Blissus leucopterus hirtus)* 	Adults are black, about 1/6 inch long. The immature nymphs are reddish or reddish-brown with white bands on their back. The adult differs from the nymph in having fully-developed wings which fold over and lie flat on the abdomen. The adults and nymphs can easily be confused with several beneficial bug species which also inhabit the thatch layer. However, chinchbugs produce a strong pungent odor when handled, unlike most of the beneficial species. Most of the damage is caused by the nymph's sucking the plant sap from the grass stems. This type of feeding will cause the grass to turn yellow before dying.	Adults and older nymphs overwinter in the thatch or areas adjacent to the lawn that provide cover (leaf litter, bark mulches, etc.). Eggs are laid in the thatch or folds in the grass blades. Chinch bugs require 30 to 40 days to complete their development. These generations generally overlap but in Maryland there are 3 or sometimes 4 generations between May and October.	Hot, dry weather and sunny locations are optimal for chinch bug development. Extended periods of rain or cool wet weather favor a fungus disease that will frequently control chinch bug populations. When to treat: May 25 to June 15 (first generation); July 25 to August 10 (second generation). Apply treatments if nymph and adult counts exceed 20 per square foot or when yellowing or brown damage first appears. Refer to Entomology Leaflets Nos. 75 or 30.

INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES
JAPANESE BEETLE *(Popillia japonica)*  Japanese beetle grub Adult	Adult: An oval-shaped beetle about ½ inch in length. The head and body are metallic green; the wings are coppery-brown in color. The adults feed gregariously and can feed on more than 275 kinds of plants. The damaged foliage takes on a lacey appearance due to the adults consuming only the tissue between the veins. Larva: A white C-shaped grub. The grub stage feeds on grass roots and causes the grass to dry out and die, leaving large brown dead patches of sod which can be rolled back from the soil.	The entire cycle requires about one year. Peak emergence period for adults occurs in early July in Maryland. Beetles emerge and remain active for about 4 to 6 weeks. Most of the egg laying occurs in July and tapers off rapidly by the first week in August. After emerging from the soil, females mate and feed for a few days. They then go back into the soil and lay 4 to 8 eggs before leaving to feed for several more days. Egg laying continues until a total of 40 to 60 eggs have been deposited. Eggs hatch in about 10 days. Root feeding by grubs during July, August and early September may be so extensive that the turf can be rolled back from the soil like a rug. By late September, the grubs (measuring about one inch in length) move down into the soil 6 to 18 inches. Here they remain inactive until the next spring. In late March or early April, they again start their upward movement and feed on roots until late May. Then they change into a pupal stage and all feeding stops until they emerge as adults.	Adult: Insecticides. Grub: 1. Insecticides 2. Milky spore dust Refer to Entomology Leaflet No. 78 for additional chemical controls.

INSECT	DESCRIPTION AND DAMAGE	LIFE CYCLE AND HABITS	CONTROL AND MANAGEMENT PRACTICES

SOD WEBWORM
(Crambus trisectus)

Adult and larva

Adult: Causes no injury to turf grasses; however, their abundance and flight activities can be used in predicting outbreaks.

Several species of webworms are present in Maryland, but the larger sod webworm appears to be one of the more important species. Adult moth is whitish or gray, about 3/8 inch long and characteristically rolls its wings around the abdomen.

Larva: The larval stage or caterpillar has several growth stages or instars. The mature caterpillar is about 3/4 to 1 inch long. Larva is light tan, usually spotted (black or reddish-brown spots). The caterpillar characteristically constructs a silken tube.

The larger sod webworm has 3 generations per year. The caterpillars and eggs overwinter in the thatch. The larvae feed primarily at night and withdraw into their silken tubes during the day.

When to treat: Apply controls when larval counts exceed one per square foot.

May 25 to June 10 (first generation). This generation rarely causes heavy damage and in most years does not require controls.

July 25 to August 20 (second generation). This generation is very important and, if not controlled, may cause severe injury or loss of sod.

September 5 to 20 (third generation). Damage by third generation larvae is frequently masked or mixed with the late, second generation injury. Thus, the potential for severe injury will continue until frost. When heavy adult flight activity is extended over a 7-week period in July and August, a spray in July and a second spray application in the last week of August or early September may be necessary for complete protection. Mow lawn before spraying and do *not* water for 3 days after treatment. Some varieties of turf grasses will recover from a heavy defoliation if watered and fertilized to stimulate new growth.

Refer to Entomology Leaflets Nos. 75 or 30.

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(Broadleaved Weeds)

WEED	DESCRIPTION AND DAMAGE	LIFE CYCLE	CONTROL AND MANAGEMENT PRACTICES
CHICKWEED *(Stellaria media)*	Winter annual reproducing by seeds and roots at the nodes of the creeping stems. Root system is fibrous and shallow. Stems are branched, creeping or ascending to heights of 12 inches. Leaves are small, opposite, single, broadly ovate, pointed at the tip, smooth. Petioles have a line of hairs on one side. Flowers are small, white with fine, deeply matched petals. Seed pod is cylindrical, breaking into 5 segments at maturity, containing many seeds. Seeds are small, dull, reddish-brown, somewhat heart-shaped but nearly round, roughened by curved rows of minute tubercules.	Seeds germinate in fall and early winter growing rapidly until extreme cold sets in. Flowering will begin in the fall and proceed during warm spells in the winter but develop profusely in the spring. Growth and seeding usually stops during extreme hot weather and seed will shatter to the ground. Most commonly a problem in fall seeded turfgrass and in areas of low maintenance.	Cultural control involves development of appropriate cultural practices to maintain a quality turf. Adequate chemical control is available. See Agronomy Mimeo 79.
DANDELION *(Taraxacum officinale)*	Perennial reproducing by seed. Root is thick, fleshy, with branches. New sprouts can come up from roots or root segments. Stem never elongates but produces a rosette of leaves. Leaves are simple, variously lobed, 3 to 10 inches long, containing a milky juice. Flower heads are smooth, hollow and borne on a long stalk from the crown bearing flower buds which develop into yellow flowers 1 to 2 inches in diameter. Seeds are about 3/16 inch long with a brownish color having a long tip with a tuft of hair.	Seeds germinate in late summer or early fall. In the first spring, a single flower may develop, but thereafter many flowers per plant develop. The wind carries the seed to new areas.	Hand weeding is generally ineffective unless root is cut 2 inches or more below soil surfaces. Adequate chemical controls are available. Cultural practices are generally ineffective.

WEED	DESCRIPTION AND DAMAGE	LIFE CYCLE	CONTROL AND MANAGEMENT PRACTICES
DOCKS *(Rumex)*	There are two species: Curled dock and broadleaved dock. Both are perennials with a large yellow, somewhat branched taproot, reproducing by seed. Broadleaved dock is similar to curled dock; leaves of broadleaved dock are broad and flat with a heart-shaped base; leaves of curled dock are mostly wavy-curled edged, lanceloate, smooth, 6 to 12 inches long. Stems of both plants are smooth, single or in groups from the root crown. Flowers of both species are in dense clusters on branches at tip of stems, without petals, small, greenish, becoming reddish-brown at maturity. Seeds of both are brown, shiny, triangular and sharp-edged, surrounded with a bract with smoothed edges in curled dock and toothed edges in broadleaved dock.	Seeds germinate in the spring; plant is a dense rosette of leaves; plant flowers the second year. Generally a problem only in seedling turf.	Broadleaved weed herbicides are effective on docks. See Agronomy Mimeo 79.

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WEED	DESCRIPTION AND DAMAGE	LIFE CYCLE	CONTROL AND MANAGEMENT PRACTICES
FOXTAIL Giant *(Setaria faberi)* Green *(Setaria viridis)* Giant green *(Setaria viridis* var. *major)* Yellow *(Setaria lutescens)*	Annual reproducing by seed: *Giant foxtail:* Leaves covered with short hairs on upper surface. Panicle extremely dense, 3 to 8 inches long bending near the bases with heads drooping; 3 to 6 bristles extend from each spikelet. Seeds greenish and smaller than yellow foxtail and larger than green. Seed head yellowish-brown in color. *Giant green foxtail:* Resembles giant foxtail except leaves are hairless. Panicle extremely dense, 3 to 8 inches long, bending near the base with head drooping. Seed head purplish-brown in color. *Green foxtail:* Leaves are hairless. Panicle extremely dense, 1 to 3 inches long, and usually erect. Seeds and seed head green and smaller than giant. *Yellow foxtail:* Leaves flat, often having a spiral twist, with long hairs on the upper surface near the leaf base. Panicle extremely dense, erect. Spikelet with 5 or more bristles. Seed larger, yellow with some dark brown.	Seeds germinate in spring. Young seedlings develop rapidly. Plants will tiller forming 4 to 8 seed heads which mature in fall. Close mowing causes spreading close to ground, particularly yellow and green foxtail. A serious weed problem found most frequently in poorly maintained turf.	Prevent spread of actively growing foxtail by developing a strong fertilization program for the desired species and collecting clippings during foxtail seed head formation. Preemergence and postemergence herbicides are available. See Agronomy Mimeo 63.
GROUND IVY *(Glecoma hederacea)*	Perennial with shallow roots, spreading by seeds and by creeping stems. Stems are 15 to 30 inches long, prostrate, 4-sided and rooting at the nodes. Leaves are rounded or kidney-shaped and hairy, opposite, borne on long petioles with a minty odor.	Common in most shaded areas. Most aggressive in late summer. Leaves die back in severe winters; however, stolons can remain viable and regenerate leaf tissue in spring.	Cultural practices generally ineffective. Adequate chemical control is available. See Agronomy Mimeo 79.

WEED	DESCRIPTION AND DAMAGE	LIFE CYCLE	CONTROL AND MANAGEMENT PRACTICES
HENBIT *(Lamium amplexicaule)*	Winter annual reproducing by seeds. Roots are fibrous; stems are slender, smooth, angled, with many branches that are more or less prostrate with ascending tips. Frequently roots where the nodes are in contact with the ground. Leaves are opposite, hairy, with rounded teeth. Lower leaves have petioles; upper leaves are without petioles and clasp the stem. Flowers are in the whorls in the axils of the upper leaves, tubular but 2-lipped, about 3/8 inch long, pinkish to purple, surrounded at the base by calyx with 5 sharp teeth. Seeds are borne 4 in a pod, sharply 3-angled, grayish-brown, about 1/16 inch long. The plant competes for space and nutrients with fall seeded turfgrass.	Seeds germinate in the fall. Plants overwinter and will begin to flower during the winter if the temperature becomes fair for several days. Plant will die in the heat of summer.	A dense cover of the desired crop will minimize the competition of the weed. Heavy infestations can threaten new turfgrass seedings. Chemical control is available. See Agronomy Mimeo 79.
KNAWEL *(Scleranthus annuus)*	Winter annual reproducing by seed, with short, slender stems, somewhat rough. Leaves are grasslike. Plant height varies 2 to 4 inches. Stems branch and spread. Flowers are greenish and clustered. Seeds are many and small.	Seeds germinate in fall and early winter; flowers and sets seed in late spring and early summer. Generally found in new seedings in the coastal plains region.	Cultural practices are generally ineffective. Adequate chemical control is available. See Agronomy Mimeo 79.
KNOTWEED *(Polygonum aviculare)*	Annual reproducing by seed. Stems are bluish-green, leafy, wiry, extending 4 inches to 2 feet in all directions. Each joint or node is covered with a thin papery sheath. Leaves are bluish-green, alternate, oblong, narrow at the base, pointed tip.	Seeds germinate in late spring and are most often found on compacted areas that are drought prone. Does well in areas of low fertility.	Cultural practices reducing compaction make desirable grass most competitive. Adequate chemical controls are available. See Agronomy Mimeos 21 and 79.
MUSTARD FAMILY (Cruciferae)	(See YELLOW ROCKET.)		

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WEED	DESCRIPTION AND DAMAGE	LIFE CYCLE	CONTROL AND MANAGEMENT PRACTICES
PLANTAINS *(Plantago)*	Perennials reproducing by seed. Stems are short with leaves forming a basal rosette. Leaves emerge from the crown. Buckhorn plantain leaves are 2 to 10 inches long, ¼ to 1 inch wide, hairy, with prominent veins running the length of leaf. Flowers are on a 4 to 12-inch long stem. The plants compete for space, nutrients, light and moisture with the turf. Rugel's plantain has a broadbladed, rounded leaf with wavy edges. Seeds are compressed along more than half the length of 5- to 10-inch seed stalks.	Seeds germinate during summer and early fall; seedling plants mature the following year to produce seed heads in late summer. Seeds ripen in fall.	Cultural control includes collecting clippings during periods of seedhead formation. Adequate chemical controls are available. See Agronomy Mimeo 79.
WHITE CLOVER *(Trifolium repens)*	Perennial with trifoliate leaves obovate, ⅓ to ½ inch long, dentate. Globe-shaped white flowers. Spreads from stolons and seeds.	Prostrate weed prolific flower formation which attracts bees. Generally found on turf areas receiving full sun and low nitrogen fertilization. Leaves will die each winter from frost; however, stolons remain to regenerate new leaves in spring.	High mowing height will make grass more competitive. Adequate chemical control is available. See Agronomy Mimeo 79.

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WEED	DESCRIPTION AND DAMAGE	LIFE CYCLE	CONTROL AND MANAGEMENT PRACTICES
WILD GARLIC AND WILD ONION *(Allium vineale)* *(Allium canadense)*	Both are perennials, reproducing by seed, aerial bulblets and underground bulblets. Only wild garlic has hard shell underground bulblets which can remain dormant for several years; both species have soft shell bulblets which do not possess any dormancy. The aerial bulblets ripen at about the same time as winter wheat and are harvested with them. Wild garlic is the predominant species. The plants are similar to each other; the following is a comparison of the two species: Wild garlic leaves are cylindrical in form and sometimes originate on the stem above ground level. Bulbs are produced in clusters at the plant base, have a fibrous covering and may be hard-shelled (brown) or soft-shelled. Flavor and odor are strong. Wild onion has a flat leaf that originates at ground level, out of the bulb. It has a single soft-shelled bulb with a netlike covering. Flavor and odor are moderate.	Plants emerge and form seeds or bulblets in the fall. With wild garlic, the hard shell bulblets must overwinter before germination or they may lie dormant for 2 or more years. Emerged plants overwinter and begin growth in the spring. Aerial bulblets about the size of kernels of wheat are formed at the tips of the slender, hollow leaves.	Cultural control, consisting of late fall plowing and early spring plowing with a cultivated crop during the summer growing season is an effective control. See Agronomy Mimeo 22, "Control Wild Garlic in Small Grains and Pastures."
WILD ONION	(See WILD GARLIC)		

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WEED	DESCRIPTION AND DAMAGE	LIFE CYCLE	CONTROL AND MANAGEMENT PRACTICES
YELLOW ROCKET and other members of the MUSTARD FAMILY *(Barbarea vulgaris)*	Winter annual, but can also be a biennial, reproducing by seed. Stems are numerous, growing upright from a crown, and branching near top, smooth and angular or ridged. Leaves are pinnately divided. Basal leaves have a large terminal lobe, are 2 to 8 inches long and form a dense rosette; stem leaves become progressively shorter with top leaves about 1 inch long and less deeply lobed. Flowers are bright lemon yellow, 4-petaled (typical mustard flower), borne in spikelike racemes on the end of each branch. Seeds are light yellow to yellowish-brown, 1/32 inch long.	Seeds germinate in late summer or fall. Plants overwinter and begin to bloom in April and continue to blossom and form seeds for about 3 months. Generally found only in seedling turfgrass.	Broadleaved weed herbicides are effective. See Agronomy Mimeo 79.

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WEED	DESCRIPTION AND DAMAGE	LIFE CYCLE	CONTROL AND MANAGEMENT PRACTICES
ANNUAL BLUEGRASS *(Poa annua)*	*Poa annua*, more commonly known as annual bluegrass, is an annual weed from Europe. Found throughout the United States, it is a most serious problem on golf course greens. *Poa annua* is often contained in lower quality lawn grass mixtures, and once established, competes with desirable grasses. *Poa annua* looks like low growing Kentucky bluegrass but is yellow-green in color and lacks rhizomes. Plant matures and dies quickly under conditions of high temperature and humidity, leaving brown patches throughout the lawn. *Poa annua* is more noticeable during the cool and moist periods of early spring and fall, just before desirable grasses begin to grow or just after they become dormant.	Seeds germinate in the fall and spring; plants overwinter to form seed heads in April and May. Since it has no runners or underground root stock, it is spread only by seed. Plant flowers and seeds profusely even under the closest mowing. It is characterized by a whitish seed head appearing in April and May.	Cultural practices include restricted water use during peak periods of *Poa annua* germination. Establishment of adequate drainage and proper timing for cultivation practices. Preemergence chemical control is available. See Agronomy Mimeos 63 and 79.
BARNYARDGRASS *(Echinochloa crusgalli)*	An annual with fibrous, rather shallow roots. Stems can be thick, coarse, mostly erect, with smooth branching at the base. Leaves, both sheaths and blades, are smooth. Blades are 3/8 to 3/8 inch wide and light green. The seed head is a panicle bearing several rather compact side branches, green or purplish in color. Florets are covered with conspicuous short, stiff bristles. The bearded seeds are tan to brown, oval with longitudinal ridges on the convex surface.	Seeds germinate in late spring and flower by midsummer. Seeds remain dormant for many years. Plants are killed by frost. Generally only a problem on poorly maintained turf lacking vigor.	Cultural practices favoring dense turf will prohibit germination of this weed. Preemergence and postemergence herbicide controls are available. See Agronomy Mimeo 63.

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WEED	DESCRIPTION AND DAMAGE	LIFE CYCLE	CONTROL AND MANAGEMENT PRACTICES
BERMUDAGRASS *(Cynodon dactylon)*	Perennial reproducing by seed, stolons (above ground stems) and rhizomes (below ground stems). Leaf blades slightly hairy or smooth except for hairs at the edge just above the collar; ligule is a fringe of white hairs. Flower borne in finger branched seed head of usually 5 branches (may be as few as 3 or as many as 7). Seeds similar to timothy. A noxious weed.	Seeds germinate in early summer to produce an aggressive seedling. Stolons will root at each node to form a new plant. Rhizomes also form new plants at each node. Seed heads are formed in late summer. Most varieties, other than common (or wild), will form no viable seed. Plants go dormant at first frost and remain so until late spring. Rhizomes and stolons may be carried with tillage equipment. Found in sunny, dry areas generally on south and east facing slopes.	Cultural control is generally ineffective; however, late fall fertilization of bermudagrass in bluegrass will increase the probability of winterkill. Non-selective chemical controls are available. See Agronomy Mimeo 71.
CRABGRASS — LARGE AND SMALL *(Digitaria)*	An annual, tufted plant, stems mostly prostrate, freely branching. The top of the inflorescences are 4 to 7 fingered, radiating outward from the main stem. The small individual flowers are in rows on one side of the flattened stalk. Seeds are long, oval, finely-granular and light yellow. There are common species; large crabgrass *(Digitaria sanguinalis* L. Scop.), and small crabgrass *(Digitaria ischaemum* Schreb. Muhl.). Large crabgrass leaves are somewhat hairy.	Seeds germinate in the spring to early summer. Flowering occurs in mid-summer as the plant matures; rooting can occur at the nodes of prostrate stems. Found in gardens, fields, lawns and waste areas. Grows well under dry, hot conditions and will germinate throughout summer if moisture is available. Extremely competitive with spring-seeded turf.	Cultural practices leading to a high quality, dense turf will preclude germination of this weed in most instances. Several preemergence herbicides are available for control of this weed. Postemergence herbicides will also control this weed. See Agronomy Mimeos 63 and 79.

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WEED	DESCRIPTION AND DAMAGE	LIFE CYCLE	CONTROL AND MANAGEMENT PRACTICES
DALLISGRASS *(Paspalum dilatatum)*	Perennial with coarse leaves that are rolled in the bud. Ligule is membranous and rounded. Sheath is compressed and midvein is prominent. Blades are flat, nearly ½ inch wide with sparse hairs near the ligule. Seed head 3 to 6 slender spikes.	Spreads vegetatively and by seed. Begins growth early in the spring. Young seedlings will form clumps in one season. Generally found on dry, low fertility areas.	Cultural practices generally ineffective. Adequate chemical control is available. See Agronomy Mimeos 63 and 73.
GOOSEGRASS *(Eleusine indica)*	Annual with prostrate growth habit. Blade is folded in the bud with apple green color. Ligule is medium long, membranous, toothed and divided by midrib. Auricles absent. Sheaths are compressed, flattened and white near the base. Two to 6 seed heads, with narrow spikes at the top of the main stem.	Germinates in late summer and is aggressive in dry areas where fertility is adequate. Forms a very tough rosette, almost impossible to pull out. Tolerates very low mowing.	Cultural practices creating competitive turf are effective. Adequate chemicals are available for post and preemergence control. See Agronomy Mimeos 63 and 79.
NIMBLEWILL *(Muhlenbergia)*	Perennial reproducing by seeds and fine stolons. Stems are smooth, slender, spreading and branching; decumbent at base with rooting at nodes. Leaves are flat and short with a few marginal hairs at the leaf base, short membranous ligule, smooth collar and loose leaf sheath. Seed head is a slender panicle 2 to 6 inches long, appearing in late summer. Seeds are very small. Found in lawns and is often confused with bermudagrass.	Plants overwinter and seeds germinate in spring. Plant develops slowly to where it may cover a square foot. Produces many small seeds in August and September. Spreads rapidly by stolons and seeds.	Cultural practices for control include collecting clippings during period of seed head formation. Some preemergence herbicides stop seed germination; however, stolon growth continues. Nonselective chemical control is available. See Agronomy Mimeo 71.

WEED	DESCRIPTION AND DAMAGE	LIFE CYCLE	CONTROL AND MANAGEMENT PRACTICES
QUACKGRASS *(Agropyron repens)*	Perennial, reproducing by seed and underground rhizomes (underground stems resembling roots). Rhizomes vary from 2 to 8 inches in depth in the soil and are about ⅛ inch in diameter. Leaves have auricles, ligule 1/32 inch long, hairy lower sheaths, upper sheaths glabrous or nearly so. Spike has 3 to 7 short-awned florets in a spikelet. The plant is a severe competitor for plant nutrients, and does not blend well with fine-leaved turfgrasses.	Seeds germinate in late spring and can flower by summer; rhizomes are generated by midsummer. Plants arising from rhizomes will be actively growing in the fall, overwinter and begin growth early in the spring or late winter. Individual rhizomes live only 2 summers and 1 winter. Roots arise only at nodes of the rhizomes.	To control quackgrass, the rhizomes must be killed, and to do this the growth of leaves must be prevented. In small areas this can be done by smothering them with tar paper, boards, straw or other material. No matter what method is used, the rhizomes must be starved. Chemicals that will help in control are listed in Agronomy Mimeo 71.
YELLOW NUTSEDGE	Perennial reproducing by seed and tubers. Roots are fibrous, bearing small nut-like tubers at the tips. Stems are erect, triangular, yellow-green. Leaves are 3-ranked and narrow. Flowers are yellowish or yellowish-brown. Seeds are yellowish-brown and small.	Vigorous plants arise from tubers. Seed germination is thought to be sparse; seeds germinate in the spring. Mature plants produce the nut-like tubers and a seed head. Usually found in poorly drained turf in full sun or partial shade.	Cultural control practices include collecting clippings during seed formation in late August and early September to prevent spread by seed. Selective chemical control is available by utilizing postemergence herbicides. See Agronomy Mimeo 74.

CHICKWEED

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DANDELION

Drawings courtesy of Jim Converse and O. M. Scott and Sons.

O - 1

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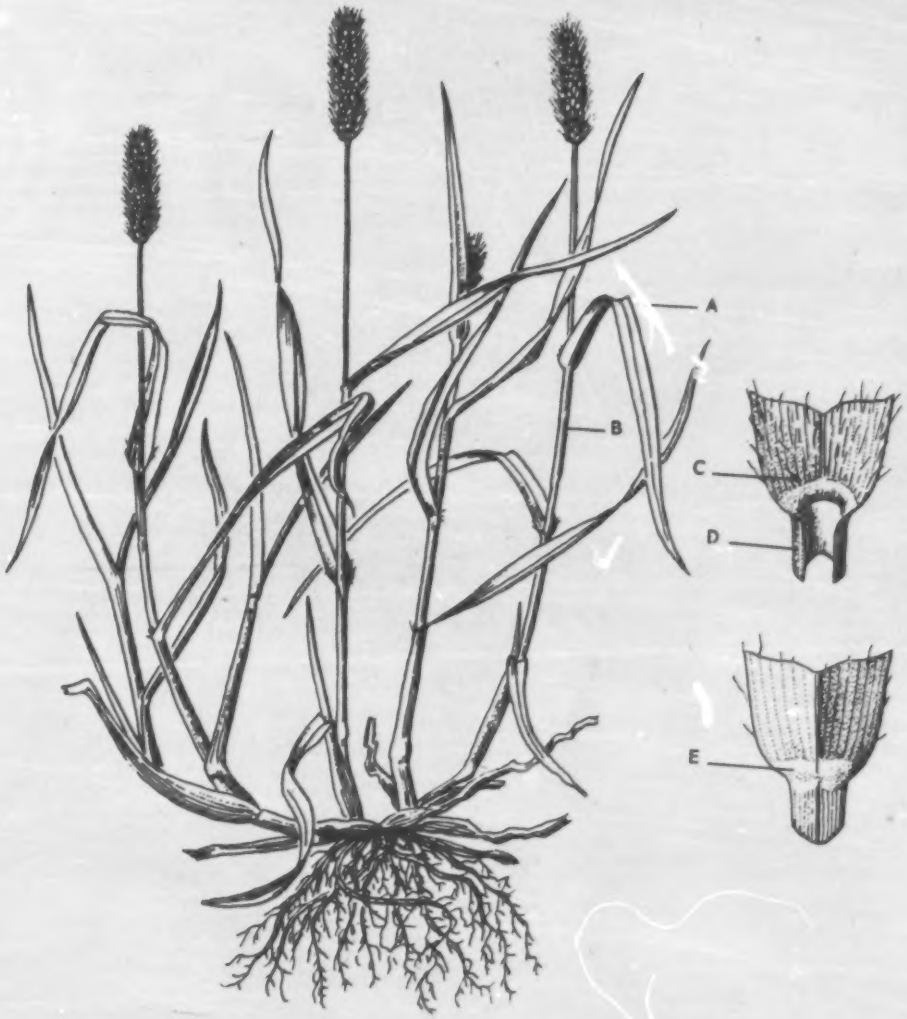
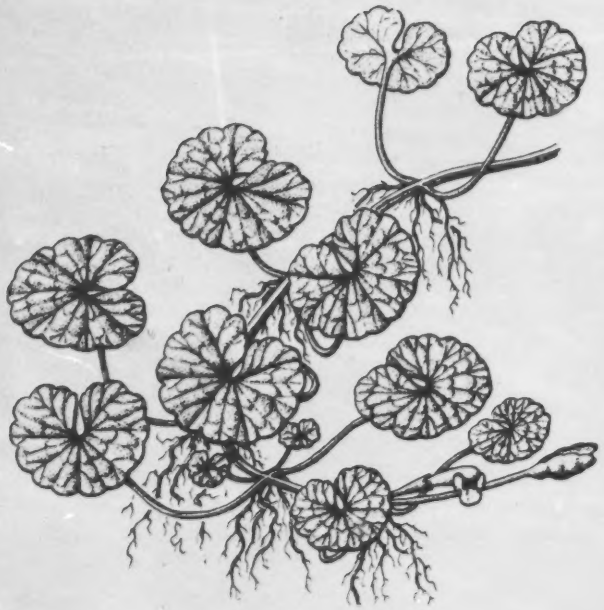


DOCK, CURLY

FOXTAIL, YELLOW

Drawings courtesy of Jim Converse and O. M. Scott and Sons.

O - 2



GROUND IVY

154

HENBIT

Drawings courtesy of Jim Converse and O. M. Scott and Sons.

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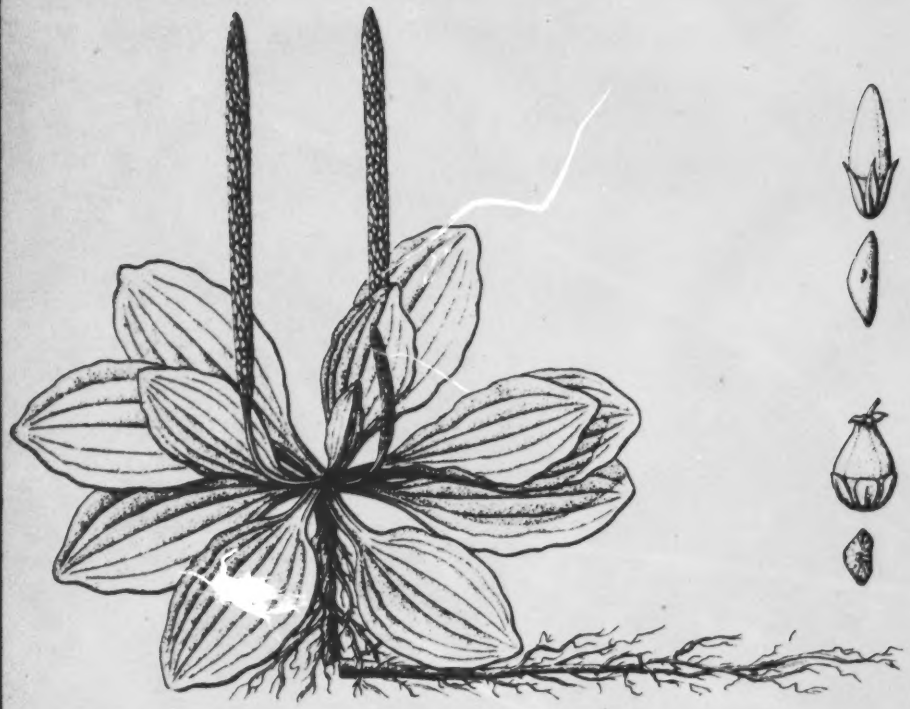
Scleranthus annuus L. Knawel. *A*, Habit—× 0.5; *B*, enlarged branch—× 2.5; *C*, flower—× 5; *D*, fruit (utricle, 1-seeded)—× 5; *E*, seeds—× 5.

KNAWEL

Drawing courtesy of Agricultural Research Service, U. S. Department of Agriculture.

KNOTWEED

Drawing courtesy of Jim Converse and O. M. Scott and Sons.

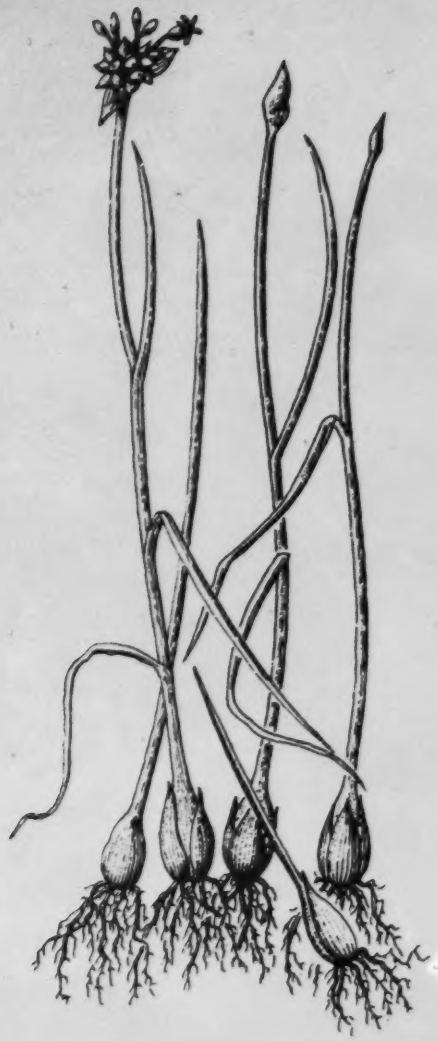


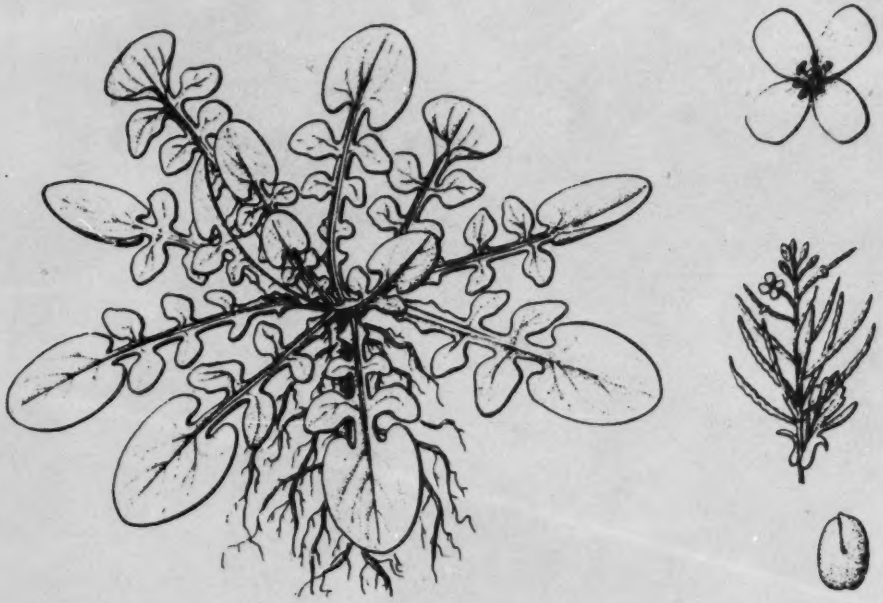
PLANTAIN
158

WHITE CLOVER

Drawings courtesy of Jim Converse and O. M. Scott and Sons.

O-159





WILD GARLIC

YELLOW ROCKET

Drawings courtesy of Jim Converse and O. M. Scott and Sons.

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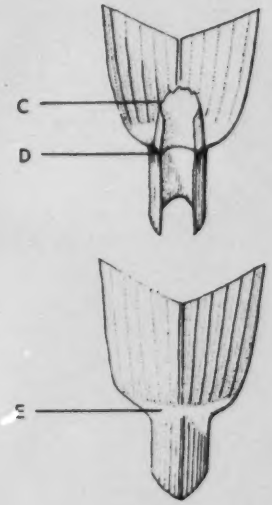

ANNUAL BLUEGRASS

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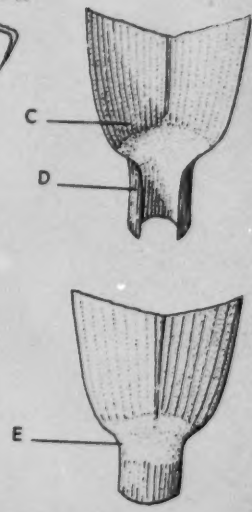
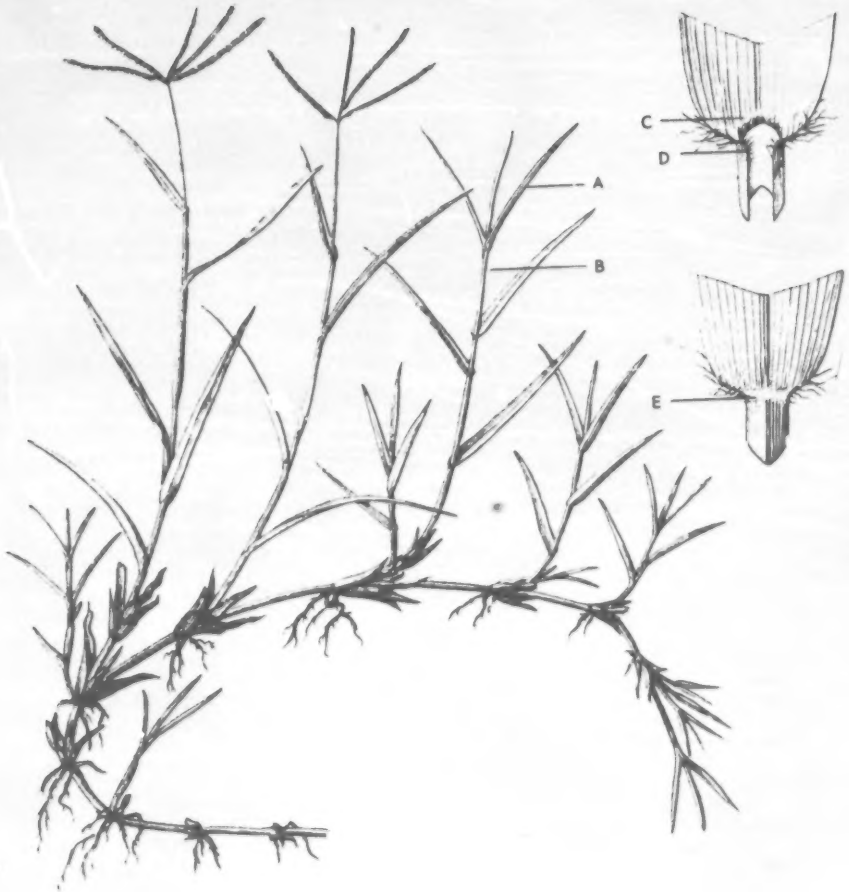
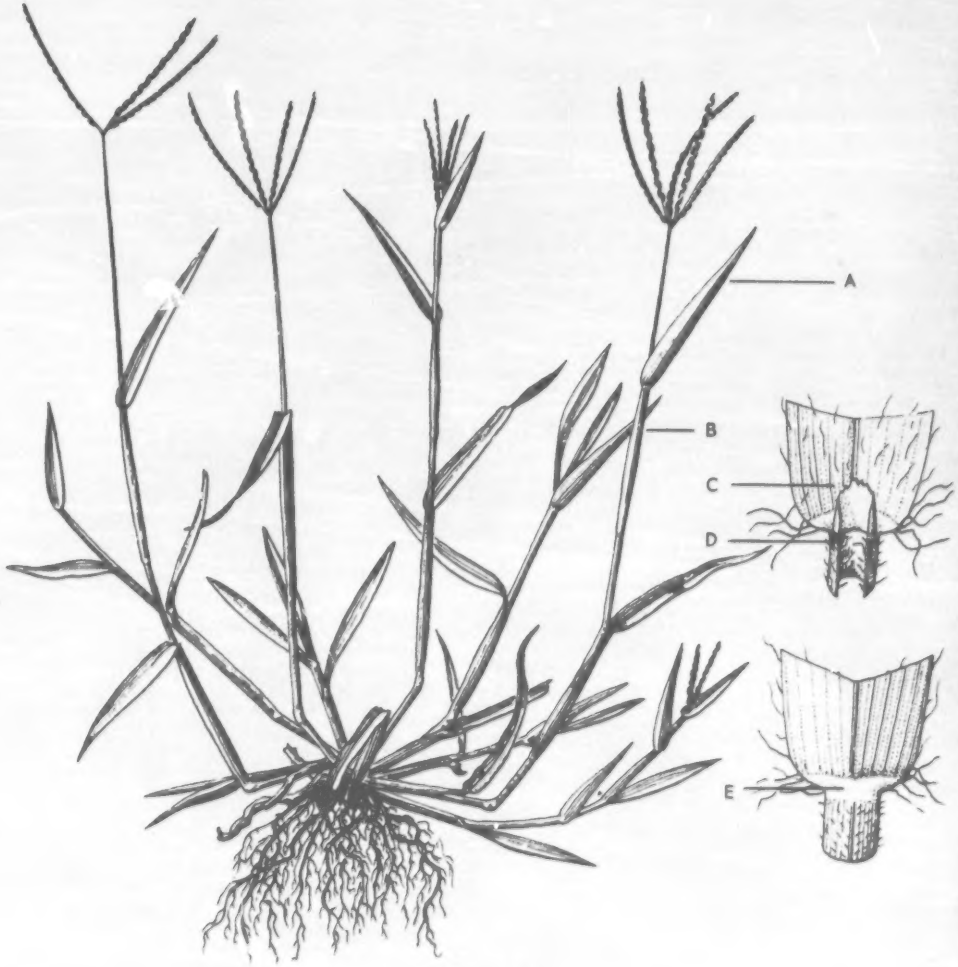


BARNYARDGRASS

Drawings courtesy of Jim Converse and O. M. Scott and Sons.



BERMUDAGRASS



CRABGRASS

Drawings courtesy of Jim Converse and O. M. Scott and Sons.

DALLISGRASS

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GOOSEGRASS

Drawings courtesy of Jim Converse and O. M. Scott and Sons.

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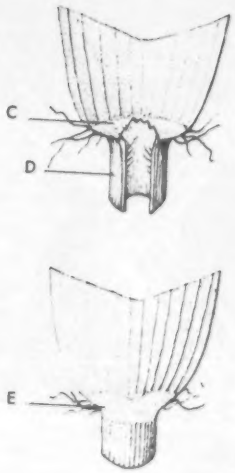

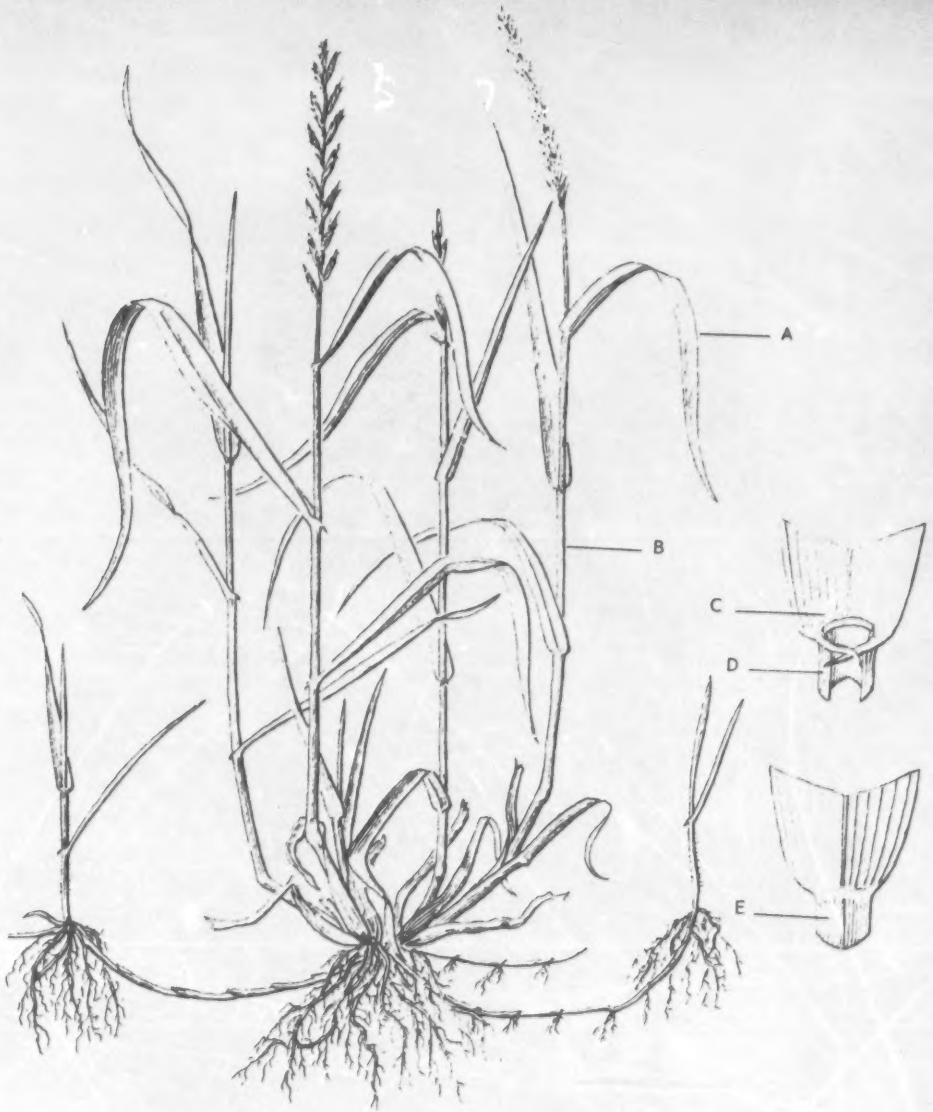

NIMBLEWILL

QUACKGRASS

Drawings courtesy of Jim Converse and O. M. Scott and Sons.

O - 10

Cyperus esculentus L. Yellow nutsedge. *A*, Habit—× 0.5; *B*, spikelet—× 5; *C*, achene—× 10.

YELLOW NUTSEDGE

Drawing courtesy of Agricultural Research Service,
U.S. Department of Agriculture.